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ABSTRACT

Presented are four information bulletins produced by the ERIC Clearinghouse for Science, Mathematics, and Environmental Education in 1981. Bulletin 1 is concerned with various pieces of information related to citizen participation activities in which citizens interact with each other to get a response from the government regarding governmental activities. Bulletin 2 contains a review of Project Synthesis as this is reported in Volume 3 of "What Research Says to the Science Teacher," produced by the National Science Teachers Association. Project Synthesis involved an attempt to use a discrepancy model in which a desired state of affairs in science education is set forth and compared with the actual state of affairs. Bulletin 3 focuses on cognitive and affective goals of problem solving as these relate to mathematics education. Bulletin 4 contains an overview of Clearinghouse activities for 1981. Nine ERIC/SMEAC information analysis products are highlighted in this bulletin, along with a description of Clearinghouse services for ERIC users. (PB)

ERIC®
Clearinghouse
for Science, Mathematics
and Environmental Education

Information Bulletin

No. 1, 1981

CITIZEN PARTICIPATION MATERIALS

Editor's Comments

This first issue of the 1981 ERIC/SMEAC information bulletin series is concerned with various pieces of information related to citizen participation. While public participation provides the theme that ties the discrete articles together, the items of information are discrete topics.

This issue of the information bulletin was prepared by Bernard J Lukco, Education Specialist, National Training and Operational Technology Center, Cincinnati, Ohio.

Introductory Remarks

The purpose of this bulletin is to provide a sample of the resources available about the concept of public participation. The term "public participation" will be used interchangeably with other terms such as public involvement, citizenship education, and consumer education. Although each term may describe a specific audience or activity, there appears to be a common desire to offer citizens an opportunity to interact with and to get a response from the government regarding governmental activities.

To meaningfully participate in this process, citizens must have an understanding of the topic being discussed and the process that encourages interaction between the public and government officials. Without knowledge of the specific topic, it will be difficult for citizens to participate in problem solving and decision making. Without the necessary skills, it will be difficult to provide efficient processes that assure dialogue and mutual sharing of information, ideas, and goals.

—Bernard J. Lukco

Penn State Addresses Advisory Group Training

Pennsylvania State University's Institute of State and Regional Affairs produced a program to help advisory groups improve decision-making in water quality planning. Titled *Working for Clean Water, An Information Program for Citizen Advisory Groups*, the program consists of 18 units based on key issues related to water quality and wastewater treatment planning. It is designed for citizens and local officials involved in environmental planning Each unit contains an audiovisual presentation (either a slide/tape or 16mm film), a citizen handbook that is to be given to each advisory group member, and an instructor's manual that will assist organizers to prepare for and conduct the sessions. The audiovisual presentations highlight major issues and important aspects of each pollution control topic The citizen handbook elaborates on these points and provides additional, more detailed information. Sessions include guided discussions of local topics and problem solving exercises. The titles of each unit indicate the water quality management and citizen involvement issues addressed.

The US Environmental Protection Agency funded the development of this series and will make it available on loan to those involved with citizen participation activities Interested persons should contact the Public Participation Coordinator at the appropriate EPA regional offices as listed below.

Regional Contacts

EPA Region 1 JFK Federal Bldg Boston, MA 02203 617-223-7213 Connecticut, Maine, New Hampshire, Massachusetts, Rhode Island, Vermont	**EPA Region 6** 1201 Elm Street Dallas, TX 75270 214-767-2630 Arkansas, Louisiana Oklahoma, Texas, New Mexico
EPA Region 2 26 Federal Bldg New York, NY 10007 212-264-0711 New Jersey, New York, Puerto Rico, Virgin Islands	**EPA Region 7** 324 E 11th Street Kansas City, MO 64106 816-374-5894 Iowa, Kansas Missouri, Nebraska
EPA Region 3 6th & Walnut Streets Philadelphia, PA 19106 215-597-8307 Delaware, Maryland, Pennsylvania, Virginia, West Virginia, District of Columbia	**EPA Region 8** 1860 Lincoln Street Denver, CO 80203 303-837-3961 Colorado, Utah, Wyoming, Montana, North Dakota, South Dakota
EPA Region 4 245 Courtland Street NE Atlanta, GA 30308 404-881-3004 Alabama, Georgia, Florida, Mississippi, North Carolina, South Carolina, Tennessee, Kentucky	**EPA Region 9** 215 Fremont Street San Francisco, CA 94105 415-556-2248 Arizona, California, Nevada, Hawaii, Guam, American Samoa, Trust Territories of the Pacific
EPA Region 5 230 S Dearborn Street Chicago, IL 60604 312-353-2149 Illinois, Indiana, Ohio, Michigan, Wisconsin, Minnesota	**EPA Region 10** 1200 Sixth Avenue Seattle, WA 98101 206-442-1266 Alaska, Idaho, Oregon, Washington

Interagency Council on Citizen Participation Formed

The Interagency Council on Citizen Participation (ICCP) is a professional organization of more than 350 federal agency staff members who have responsibility for some aspect of citizen participation in the 80 agencies represented. ICCP was formed to provide a clearinghouse where members can exchange information and ideas about innovative approaches and to encourage and support successful and productive citizen participation programs by cooperating with citizen organizations, government agencies, and academic associations. ICCP holds monthly meetings and sponsors conferences and symposia. A March 1977 conference on Citizen Participation in Government Decision-Making provided an opportunity for federal employees and representatives from national organizations to discuss citizen participation policies, legislation and an evaluation to improve constructive public involvement in agency decision-making processes. The proceedings of the conference, *At Square One*, address both government constraints in working with the public and public constraints in working with the government. Problems were identified and discussed, and possible remedies suggested. The following problem statements summarize the concerns of the participants:

* Agency resources (personnel, expertise, funding, organization) for efficient and effective execution of citizen participation in decision-making processes are weak when compared with other agency responsibilities.

* The policy, commitment, and initiative of agency leadership on citizen participation in the decision-making process have been of significantly uneven quality and priority.

* The planning, execution, and evaluation of citizen participation programs are poor and often well below known state-of-the-art acceptability.

* Agency policy and practice in citizen participation processes are unresponsive to real needs and priorities of a large segment of the public.

* Citizens often lack relevant information about the agency, the process and the issue, options and impacts, their rights, and what the real stakes are.

* Citizens believe that the participatory process lacks visibility and equal accessibility, consistency among agencies, fairness to all interests, and documented accountability for agency actions.

* Many citizens lack confidence in government and distrust agency officials, neither believing them nor respecting their authority.

* Some social and cultural factors, individually or in the aggregate, severely hinder many segments of the public from constructive participation in agency decision-making.

* A limited number of copies of the proceedings with the full texts of talks, panel presentations and an expanded review of the problems can be obtained, while supply lasts, from:

Lee Gray
Coordinator for Citizen Participation
Office of Consumer Liaison
US Department of Transportation
Washington, D.C. 20590

The ICCP Newsletter provides information on events, publications, conferences, and the activities of government agencies, and public interest groups which work on citizen participation issues. Call 202-632-7000 to be placed on the mailing list or write to the above address

EPA Publishes Public Participation Guides

The Areawide Water Quality Management Program, established by Section 208 of the Clean Water Act, has provided an impetus for increased citizen involvement activities over the past several years. This program requires local and state officials to systematically involve citizens and interest groups in governmental decision-making. Both the process of transferring technical information on pollution control topics and the process of conducting public participation activities have evolved and are becoming more responsive to the needs of the public. A number of publications and materials developed and supported by the U. S. Environmental Protection Agency relate to water quality management functions. Although most are slanted toward pollution control, they are nevertheless of significance for any individuals with citizen involvement interests.

An information source that is available from the U.S. Environmental Protection Agency is a series of water quality management reports. The first issue of these reports was devoted to an overview of water quality management and included articles on nonpoint sources, wastewater treatment alternatives, and a reference list of state water quality management agencies. A March 1980 report addressed Farmers and Clean Water. The reports are published from time to time and are available, free, upon request. Inquiries should be addressed to WQM Reports (WH-554), Environmental Protection Agency, 401 M Street SW, Washington, D.C. 20460.

Three guides that give planners, agency staff and organizers of citizen involvement tasks useful, in-depth information about the running of effective public meetings, making the best of advisory committees, and using sound media techniques are

Guide 1—E[illegible] Public Meetings
Guide 2—[illegible] Effectively with Advisor[illegible]es
Guide 3—[illegible] Use of Media

Each is org[illegible] to provide basic practical tips as well as guidance for organizing a public participation program over the long term. These guides are meant to be used as reference materials with a full range of suggestions designed to fit many specific local situations. A limited number of copies of these guides is available from the Water Planning Division (WH-554) US Environmental Protection Agency, 401 M. Street SW, Washington, D.C. 20460

How to Write a Public Notice: A Collection of Examples is a booklet that provides some principles regarding public notices, a public notice checklist, examples which have been used in environmental programs, and commentary on these examples which highlights their strong and weak points. This booklet is useful for persons who have little or no experience in writing information for the public or in working with the media A limited number of copies is available from the Environmental Protection Agency, Office of Water Program Operations (WH-546), Washington, D.C. 20460.

Maintaining the Course for Clean Water was produced by the National Wildlife Federation under a grant from the Environmental Protection Agency. It is the purpose of this handbook to assist and guide effective citizen participation All aspects of 208 planning are covered, including legislated requirements, sources of pollution, the citizen's role, and alternative programs to control water pollution problems Copies are available by writing to:

Water Planning Division (WH-554)
US Environmental Protection Agency
Washington, DC 20460

Single copies also available from the National Wildlife Federation's Education Division, 1412 16th Street NW, Washington, D.C. 20036.

Towards Clean Water: A Citizen's Guide to Action examines current water pollution control legislation focusing on the key points at which decisions are made and provides guidance to citizen leaders on means of assuring the most environmentally sound implementation of the law. Copies of this 328 page document can be purchased for $8.00, plus $1.50 for shipping and handling, from the Conservation Foundation, 1717 Massachusetts Avenue, NW Suite 300, Washington, D C. 20036.

A report, *Citizen Involvement is OCPC 208 Planning: A Progress Report*, was prepared as part of the Old Colony Planning Council's (OCPC) areawide water quality management planning process It discusses the overall goals and the way in which public involvement became an integral part of both the technical and decision-making elements. Each of 15 public participation mechanisms actually used during the first 8 months of the project is described in detail. Also included is an evaluation and analysis of he effectiveness of the public participation program, obstacles, significant local issues, problems and staff responses. Copies of the report #WPD 7-76-01 can be obtained from Water Planning Division; US Environmental Protection Agency, (WH-554) Washington, D.C. 20460.

A Practical Guide for 208 Areawide Quality Management is the first of several documents that provide technical assistance to local agencies with responsibility in the area of water quality management Produced by the National Association of Regional Councils, the report summarizes information gained at three technical assistance workshops Topics include guidelines for implementation, regulatory procedures, financing methods, community involvement and environmental programs. Another publication produced by this organization entitled, *Cleaner Water Through Areawide Action*, addresses areawide planning and documents some exemplary accomplishments. Copies can be obtained from the National Association of Regional Councils, 1700 K Street, NW, Washington, D.C. 20006.

The *208 Data Clearinghouse* was originated to aid local agencies in obtaining technical reports of other agencies that may contain applicable solutions toward 208 plan completion and implementation The current issue includes approximately forty subjects reviewing all aspects of water quality management. The subjects range from actual work plans of local agencies, non point source best management practices, to public participation. The subjects are broken into separate entries which are categorized and numbered. Each entry includes bibliographic information describing the document and its contents and the name of the agency which produced the document. Additional information and a copy of the current data base can be obtained from: 208

Data Clearinghouse, US Environmental Protection Agency, (WH-554), 401 M Street., SW, Washington, D.C. 20460.

Another valuable resource available is the *6th Edition, Annotated Bibliography for Water Quality Management*. The entries are divided into five categories: Basic Information Materials on Water Quality Management, Exhibits-Films-Training Programs, Water Planning Division Publications; NTIS Publication, and Other Publications. Each is referenced and followed by a short abstract information concerning this document and a copy (while the supply lasts) can be obtained from the US Environmental Protection Agency, Water Planning Division, (WH-554). 401 M Street SW Washington, D.C. 20460.

A New Citizens Guide to Clean Water is a 72 page booklet describing the major components of the Clean Water Act and the citizen involvement activities within the scope of the Act. Produced cooperatively by the Izaak Walton League of America and the Environmental Protection Agency, sample copies can be obtained free by writing:

Izzak Walton League of America
1800 N. Kent Street
Arlington, Virginia 22209

University of Massachusetts Initiates Training Project

A series of eight manuals has been produced by the Citizen Involvement Training Project (CITP) at the University of Massachusetts at Amherst with funds provided by the W.K. Kellogg, Blanchard and Polaroid Foundations. Each manual addresses a topic that will assist people to learn how to identify and then acquire the skills they need as citizen group members.

The Rich Get Richer and the Poor Write Proposals is intended to develop strategies and skills for fund raising. The main focus is to explore some solutions to problems that are common to most fund raisers and to suggest some preventive measures for avoiding the usual pitfalls.

Power: A Repossession Manual is written to encourage the growth of a culture of community organization and to make the process of mobilizing a community and the skills involved known to all those who will be a part of an organizing process.

Planning, for a Change is designed to give the reader assistance with planning activities related to group action.

Playing Their Game Our Way is about how to use the governmental processes to plan to solve social problems and how to develop clout to hold elected and appointed officials accountable to carry out those plans.

We Interrupt This Program . . . is a manual for the average citizen and citizen group with virtually no resources and only limited success with the media. It attempts to provide information to expand resources, better understand the dilemmas and difficulties of the media, techniques of persuasion and the market research analyses.

Working Together is a unit on the group process and shows how to utilize more effectively the many boards, councils, and citizen groups to operate cooperatively in order to accomplish common goals.

How to Make Citizen Involvement Work provides guidance to assist citizens to monitor, analyze and criticize the quality of citizen involvement activities in their communities.

Beyond Experts: A Guide for Citizen Group Training is for people who might take an active role in training and for those who would like to draw a group's attention to skill-building activities. It can serve as a refresher as well as a reference for community organizers, Cooperative Extension Service agents, community college instructors, agency personnel with citizen liaison responsibilities, and others who deal with citizen groups.

Each manual contains valuable resources including references cited in the manual, anthologies, government agency studies, citizen action guides, demonstration projects, resource organizations, and other bibliographies. The Citizen Involvement Training Project also provides bilingual training workshops, materials and consultation to citizen groups.

Manuals are priced at $6.00 each with a 10% discount for an order of 4-20 books and a 20% discount for over 20 books. Orders and requests for additional information should be sent to:

Sally Habana Hafner
Citizen Involvement Training Project
138 Hasbrouck
University of Massachusetts
Amherst, Massachusetts 01003
Telephone (413) 545-2038

Lincoln Filene Center Focuses on Citizenship and Public Affairs

The purpose of the Lincoln Filene Center for Citizenship and Public Affairs is to improve the quality of citizen participation in social and governmental institutions and to understand the factors that define productive participation. The Center asks why some individuals and groups are more able than others to contribute thoughtfully, ethically and effectively to the resolution of public programs. Affiliated with Tufts University, the Center engages in research, conducts and evaluates demonstration programs, publishes research and training materials, and conducts training programs for citizens, leaders in the voluntary sector, and instructors. Publications include:

Citizen Participation in America, edited by Stuart Langton, who holds the Lincoln Filene Center Chair in Citizenship and Public Affairs at Tufts University

A collection of essays on citizen participation, perhaps the most comprehensive and contemporary analysis now available.
122 pages, 1978, $8.95.

Citizen Participation Perspectives: Proceedings of the National Conference on Citizen Participation, edited by Stuart Langton.

The proceedings of the first National Conference on Citizen Participation held in Washington, D.C., Fall, 1978.

This publication contains major speeches by Senator Edward M. Kennedy, Alvin Toffler, Ralph Nader, Sam Brown, Andrew Young and others. It includes 35 workshop papers and recommendations for the future. It is a compendium of rich source material for scholars, teachers, government officials and citizens.
279 pages, 1979, $12.95.

The Future of the Environmental Movement, Stuart Langton, Lincoln Filene Center, Tufts University.

This pamphlet is an essay characterizing the challenge to environmentalists for the 1980s. It argues that environmentalists should possess new maturity and new competencies such as skills in management, a knowledge of how to collaborate, skills in civic action, and the capacity to assess complex scientific and technological phenomena.
8 pages, 1978, $2.00

How to Use the Media Effectively, Nancy W. Anderson, Environmental Coordinator, Lincoln Filene Center

This pamphlet is a primer for lay and volunteer persons on how to employ radio, television, and the press effectively.
12 pages, 1978, $2.00

How to Write a Proposal, Stuart Langton, Lincoln Filene Center, Tufts University

This pamphlet discusses the ten common elements contained in a good proposal. It outlines the concept of using charts and graphs to illustrate important parts of a proposal. Simple charts and a budget are included.
8 pages, 1979, $2.00

Citizen Participation

This newsmagazine, national in scope, reports and analyzes current practices and research in citizen participation. Growth in both citizen-initiated and government-initiated citizen participation may be a dominant force for the remainder of the century. This newsmagazine explores the meaning of this phenomenon and provides additional information on how democratic practice in America is changing and prospering. 1 year — $12.00; 2 years — $20.00.

Prior to 1973, the Center published curriculum materials and cases for use

in the schools. Some of these materials are still available. A list of such publication is available upon request.

All publications are in paperback. When ordering, include 48¢ postage for each book and 28¢ postage for each pamphlet. Orders and requests for additional information should be sent to:

Lincoln Filene Center for Citizenship and Public Affairs
Tufts University
Medford, MS 02155
Telephone: (614) 628-5000, Extension 353

NTIS Provides Technical Reports

A major source of government publications is the National Technical Information Service (NTIS) which provides both paper and microfiche copies of technical reports. Information on availability and prices is given only by mail and can be obtained by writing to NTIS and providing the following information:

1. Title of the Report
2. NTIS accession number
3. Number of copies required
4. Paper copies or microfiche

NTIS will respond by mail with a price quote and availability statement. Publications can then be ordered by mail with payment included. Write:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161

Some NTIS publications of interest to bulletin readers are described in this section.

Public Involvement in the Corps of Engineers Planning Process. James R Hanchey U S Army Engineer Institute for Water Resources NTIS AD A017 946

The approach to public involvement program development here assumes that planning should consist of sequential stages with definable decision points, and that explicit consideration of public viewpoints must be undertaken before decisions are made Contains specific "how to" information on obtaining citizen input, disseminating information, budgeting for public involvement and evaluating its effectiveness

Public Participation in Water Resources Planning: An Evaluation of the Programs of 15 Corps of Engineers Districts. James F Ragan, U S Army Engineer Institute of Water Resources NTIS AD A019 966

This report examines the public involvement programs of fifteen Army Corps of Engineers field offices All programs are described, with two used as detailed case studies The bulk of the report divides planning into five basic stages, gives guidance as to what could be done to involve the public at each stage, and finally describes what is being done by the Corps. An interesting last chapter describes the constraints on effective public participation both from the bureaucratic system, and from citizens themselves

Water Resources Decision Making on the Basis of the Public Interest. Report No IWR Contract Report 75-1 U S. Army Engineer Institute for Water Resources. NTIS AD A010 402

The concept of water resources decision making in the public interest is both fundamental and [illegible]re This report discusses alternative perspectives that have been suggested for defining the public interest and provides an overview of the decision making involved in a typical water resources planning study. It then examines various approaches to determining the public interest in pre-authorization planning and decision making

Conservation Districts and 208 Water Quality Management, National Association of Conservation Districts and EPA, June 1977. Available from NTIS PB 274-411

Highlights potential conservation district involvement in the preparation and implementation of state and areawide water quality management plans developed pursuant to Section 208 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) It is keyed to the 16 required water quality management planning elements specified in EPA regulations The document is directed primarily to water quality planners, conservation districts, and state soil conservation agencies (boards, commissions, committees, councils or equivalent). Those federal and state agencies with whom conservation districts have cooperative working arrangements, as well as various public interest groups may also find the material of interest

Structuring Communications Programs for Public Participation in Water Resources Planning. Utah State University, Department of Civil and Environmental Engineering, and the United States Army Engineer Institute for Water Resources. May 1975 NTIS AD A012 208

The report describes the Corps of Engineers' planning and defines the information generated during the planning activities. The planning process is related to various communication models and an approach to development of public participation is suggested Various techniques and methods for communication with the public are presented. The report concludes with several examples of public participation programs and the relation of these programs to environmental impact assessment and water quality management

Communication for Urban Water Resources Management—A Review and Annotated Bibliography. R M Males and T J Cooke, W.E Gates and Associates Inc, February 1974 NTIS PB 233-332

The review is intended as a source-book for professionals interested in utilizing the findings of communications research on the design and conduct of public involvement programs for urban water resources A basic presentation of the fundamental findings of communications theory, in the areas of basic communications processes, mass communications/persuasions, small group processes and face to face communications is included

The Role of Citizen Advisory Groups in Water Resources Planning. Madge Ertel, University of Massachusetts at Amherst, Water Resources Research Center, July 1975. NTIS PB240-877

This report is a result of systematic, case study observation of the citizen advisory groups operating in conjunction with three observation recognizance level planning studies of the New England River Basins Commission Citizen Advisory groups can serve as one component of a public participation program and can provide a valuable link to other strategies included in the program The report includes a set of practical guidelines for the use of planning agencies seeking to maximize the effectiveness of citizen advisory groups

Journals Stress Public Participation

Various perspectives about public participation are explored in a number of journals. Topics range from methods for conducting advisory group meetings to citizen involvement research concerns. The field of education has assumed a major role in the refinement of public participation concepts and skills. As a result, persons interested in public participation should become acquainted with *Current Index to Journals in Education* (CIJE). This monthly publication includes annotations of articles relevant to the concerns of educators interested in the issue of public participation. Although the following annotations do not represent a complete search of the 786 major educational and education-related journals listed in CIJE, they do provide a sample A more complete search of the ERIC data base and other data bases will be necessary for those persons with specific interests in the topic of public participation.

EJ 131 669 SP 504 181
Leadership in Citizenship Jaworski, Leon, *Today's Education*, v64 n1, pp54-5,58-9, Jan-Feb 75

*Leadership, *Citizenship, *Laws, *Citizen Role, *Citizenship Responsibility, Civics, Citizen Participation, Elementary Secondary Education

This article states that the schools throughout our country have a great need today for instituting an enlarged and improved program of youth education in the fundamentals of law in a free society and in the responsibilities of leadership (Reactions are also included) (RC)

EJ 133 322 SE 515 719
NSF: Trying to Cope with Congressional Pressure for Public Participation Culliton, Barbara J, *Science*, v191 n4224, pp274, 318, Jan 76

*Citizen Participation *Financial Support, *Political Issues, *Scientific Research, Federal Aid, Foundation Programs, Government Role, Public Opinion, Science Education, (*National Science Foundation, NSF)

Describes political viewpoints surrounding a Congressional plan to create a National Science Foundation (NSF) program that would allow public interest groups greater participation in deciding what types of scientific research should be funded (MLH)

EJ 150 724 SO 505 175
Citizenship as the Aim of the Social Studies Foshay, Arthur W Burton, William W, *Theory and Research in Social Education*, v4 n2, pp1-22, Dec 76

*Citizenship, *Justice, *Social Studies, *Program Descriptions *Textbook Evaluation, Program Content Program Effectiveness, Elementary Secondary Education

Two criteria for social studies programs are presented (1) deal directly with the concept of justice, and (2) provide for the direct practice of citizenship Four texts are examined for meeting the criteria Finally, a hypothetical grades 1-12 program is described that meets the criteria (ND)

EJ 152 479 SP 505 252
Citizen Involvement Artz, Robert M, *Parks and Recreation*, v11 n7, pp-48-51, 85, 118 Jul 78

*Citizen Participation *Recreational Programs *Cooperative Planning *Community Recreation Programs, Planning Commissions Policy Formation, Community Action, Citizens Councils, Advisory Committees, Community Cooperation

The effectiveness of any recreation and park organization depends upon the involvement, cooperation and work of many individual citizens and groups (JD)

EJ 161 185 SO 505 590
New Case Studies of Citizen Action Tanner, Thomas, *Social Science Record*, v14 n3, pp28-30, Spr 77

*Environmental Education *Social Studies, *Case Studies, *Instructional Materials, *Citizen Participation, Activism, Curriculum Evaluation, Higher Education, Secondary Education

Describes a six-unit case study curriculum package designed for secondary and college-level courses relating to environmental education The units deal with nuclear power, stream channelization, a river dam project, overgrazing of public lands, agribusiness versus the family farm, and swamp preservation (Author/DB)

EJ 176 174 PS 506 547
Social Studies: Ways to Influence Elected Gov-

ernment Officials Crowder, William W , *Instructor,* v87 n8, pp142-4, 146-7, Mar 78
* Social Studies * Elementary Education * Teaching Techniques, * Citizenship, * Citizen Participation, Government (Administrative Body)

A social studies unit designed to help students learn first-hand how to exert pressure on elected officials (SB)

Reprint Available (See p vii). UMI

EJ 177 987 HE 509 942

An Experiment in Environmental Education for Citizen Advocates Krimsky, Sheldon. deNeufville, Judith I., *Alternative Higher Education. The Journal of Nontraditional Studies*, v2 n3. pp210-22. Spr 78
* Environmental Education, * Activism, * Field Experience Programs, * Citizen Participation, * Course Descriptions, * School Community Relationship, Higher Education, Graduate Students, [* Citizen Advocates], [Experiential Learning, Tufts University]

A prototype of a college-level adult-centered environmental education program is described whose target population is citizens serving as volunteers in local planning boards, conservation commissions, and environmental organizations The model involves enrolling experienced citizens in courses with graduate students as community organization interns. (Author/LBH)

Reprint Available (See p vii). UMI

EJ 180 261 SO 506 336

A Dialogue with Socrates Ryan, Mack, *Social Studies*, v69 n2, pp50-1. Mar/Apr 78
* Social Studies, * Philosophy, * Platonism, * Dialogue, * Citizenship Responsibility. Moral Issues, Moral Development, Social Problems, Secondary Education

Presents a dialogue between Socrates and his Athenian admirers regarding the importance of educating youth for responsible citizenship The manuscript was recently discovered by archivists of the Greek government and is assumed to be a record of a dialogue that occurred immediately after Socrates had been poisoned for his role in corrupting the youth of Athens (Author/DB)

EJ 206 812 AA 529 881

Active Citizenship: Learning by Doing. Chamberlin, Charles *Elements' Translating Theory into Practice,* v10 n5 p1-4 Jan 1979

Descriptors *Basic Skills, *Citizen Participation. *Citizenship Responsibility, Communication Skills. Cooperation, Decision Making, Elementary Education, *Experiential Learning, *Political Socialization, Social Studies

Suggests basic competencies for civic participation and ways these skills may be taught in the elementary grades. (SJL)

Periodicals which frequently address public participation issues and their addresses are:

American Journal of Political Science, Wayne State University Press, 5980 Cass Avenue, Detroit, Michigan 48202

Journal of the American Institute of Planners, 1776 Massachusetts Avenue, N.W., Washington, D.C. 20036

Journal of Voluntary Action Research, Association of Voluntary Action Scholars, Box G-55, Boston College, Chestnut Hill, Massachusetts 02167

Public Administration Review, American Society for Public Administration, 1225 Connecticut Avenue, N.W., Washington, D.C. 20036.

Public Interest, National Affairs, Inc., Box 542, Old Chelsea Post Office, New York. New York 10011

Citizen Groups Can Make Use of "Green Machine"

A book that can serve many public participation purposes, *Tuning the Green Machine*, is a basic text for anyone who wants to understand environmental concepts and their relationship to current policy. It is suitable as a high school primer on the environment, as a introduction for citizen groups dealing with pollution control issues, and as a ready reference. It discusses the nature of earth and its vital elements: air, water, soil, and energy. The elements are subsequently related to pollution effects and remedies. This book, developed from a US Environmental Protection Agency program, contains 14 chapters. Chapter headings suggest the scope of pollution control information required for decision-making:

1. The Nature of Planet Earth
2. The Nature of Water
3. The Nature of Air and Weather
4. Airsheds and Air Pollution
5. Air Pollution Sources and Controls
6. Watersheds, Soils and Water
7. Water Pollution Sources
8. Water, Stream Biology and Pollution
9. Water Use and Treatment
10. Coastal Zones
11. The Environment and Human Health
12. Energy Conservation and Resource Alternatives
13. Pollution Abatement Policies and Standards
14. Natural Systems and Land-Use Planning

Written by persons representing the Institute for Environmental Education and the Association of New Jersey Environmental Commissions, the book can be ordered from:

Oceana Publications, Inc.
75 Main Street
Dobbs Ferry, New York 10522
Price: $10.00 plus .75 handling

The Food and Drug Administration and Consumer Affairs

The Department of Health and Human Services, Food and Drug Administration (FDA) is active in public involvement efforts. The Food and Drug Administration's Office of Consumer Affairs has the lead responsibility for involving consumers in the agency's decision-making process and administering the public participation program.

The National Consumer Awareness and Access Project (NCAAP) is a clinical prototype course on the Food and Drug Administration's administrative practices and procedures and is designed for experimental implementation at three levels—law schools, consumer advocate groups, and grassroots consumers. It is taught in English and Spanish. A major objective of the course is to raise general awareness of FDA and its statutory responsibilities to ultimately enable grassroots consumers to act on their own behalf, in lieu of legal representation, in gaining access to the Agency through petitions, evidentiary hearings process, and commenting on proposed rules and regulations.

A search continues for candidates to serve as consumer representatives on FDA's public advisory committees. The Agency receives advisory opinions from technical committees in the areas of prescription drugs, medical devices, biological products, toxicological research, medical radiation, and radiation safety standards. Most committee members are experts in their respective fields. To assure that consumers' needs are adequately addressed, the Office of Consumer Affairs is seeking consumer advisors knowledgeable in the above topics who can adequately represent the public interest on these technical advisory committees.

The FDA's pilot reimbursement program represents another aspect geared to enlarging public participation opportunities. Because participation in administrative proceedings can be expensive, consumers and small businesses are not always available to present their views for consideration. By reimbursing eligible participants who could not otherwise afford to participate, a greater diversity of views is brought into the decision-making process.

The *Consumer Update* is a publication that the FDA uses to alert consumers to the Agency's public involvement activities. It is intended to keep readers up to date on FDA actions, increase understanding of the decision making processes and encourage participation. Anyone interested in receiving a copy should send a request to be placed on the mailing list to

Office of Consumer Affairs (HFE-30)
Food and Drug Administration
5600 Fishers Lane
Rockville, Maryland 20857
(301) 443-5006

Case Studies Suggest Models

Local, state, regional, and national environmental action groups have developed environmental education programs in support of their goals. From a representative nationwide sample, reports on how they successfully (or unsuccessfully) organized and involved the public are presented in case study format in the book, *Environmental Education in Action-III: Case Studies of Public Involvement in Environmental Policy.* The 27 examples describe how the groups mobilized public opinion in favor of beneficient land use of recycling of wastes, or against a potential plant site, or in favor of pollution control legislation, or towards incorporating environmental studies more effectively in the curriculum. Selected and edited by John Disinger, The Ohio State University, and Clay Schoenfeld, University of Wiscon-

sin, the 499 page book can be purchased for $6.05.
Order from:

Information Reference Center (ERIC/SMEAC)
The Ohio State University
1200 Chambers Road
Columbus, Ohio 43212

Persons wishing to avoid postage and handling charges should send prepaid orders. The document is also available, as ED 168 886, from the ERIC Document Reproduction Service (EDRS), P.O. Box 190, Arlington, VA 22210.

Audiovisual Case Studies of Public Participation

Audio visual materials can be effectively used to inform citizens about specific issues and also to educate them about methods of citizen involvement. The following audiovisuals were selected primarily as case studies of public participation efforts or as training units for concerned citizens.

Voices. Voices is a chronicle of environmental action and Jeffersonian ferment unlike anything seen on American soil for generations. Beginning in Chicago with citizens fighting a billion-dollar crosstown expressway, the film documents various environmental actions-the efforts of Clevelanders determined to take part in planning for a new jetport in Lake Erie and the work of farmers in Missouri determined to protect their land against government dam builders. Narrated by William Conrad with the music of singer-composer Don McLean. 1974. 28 Minutes. Cleared for TV.

Speak Up People are speaking up about environmental problems in their communities. This film relates to the Federal Water Pollution Control Act Amendments of 1972 which mandated a timetable for cleaning up our lakes and streams. For the first time, it encourages, provides, and, indeed, insists that we citizens become involved in the decisions that will affect the quality of our daily lives, no matter where we live or who we are. But the law only provides the opportunity. The rest is up to each of us. If we don't speak up, others will and we may not agree with their decisions. 1976. 11 Minutes. Cleared for TV.

The Gifts. Documentary film about the American landscape depicting the environmental degradation that has occured over the last two centuries. The scene moves through 18 States showing dismal pictures of poisoned fish, garbage-filled waterways, dead oil-coated birds and air turning into smog. Narrated by Lorne Greene from a script by Robert McBride with original music by Skitch Henderson, this is an inspiring introduction to environmental problems, ideal for classroom and citizen action groups use. EPA-produced 26-minute film.

These three films are available from

Modern Talking Picture Service
Central Distribution Office
2323 New Hyde Park Road
New Hyde Park, New York 11040

A Question of Values. This film illuminates an intense public debate in a small Maine town torn by conflict between environmental preservation and economic development. A New York oil company wants to build a modern oil refinery in Maine. Crude oil would be provided by giant 200,000-ton tankers which would move through rocky approaches to Penobscot Bay. Huge oil spills could wipe out lobstering, fishing, and the tourist-based economy of the area. But there is high unemployment in the area, and the refinery would bring jobs and attract satellite industries. The Maine people involved have taken sides because they know their future could be at stake. 1972. 28 minutes. Not cleared for TV. Available on a free-loan basis by writing to:

RHR Filmedia, Inc.
1212 Avenue of the Americas
New York, N.Y. 10036

A Small Victory. A 28-minute film documentary. Traces the citizen action inspired by the water quality condition of Lake Winnisquam in New Hampshire which ultimately led to the initiation of the Winnipesaukee River Basin Project. Available for viewing from:

Lakes Region Planning Commission
ATTN: Rick Saunders
Main Street
Meredith, NH 03253
or
New Hampshire Water Supply and Pollution Control Commission
105 Loudon Road
Concord, NH 03301

In Order to Change. Produced in Chicago, this film tells of a community group that won environmental safeguards. 90-minute film produced by the University of Illinois. Available from

Film Comm
208 S. LaSalle Street
Chicago, Illinois 60604
312-263-0497

Toxic Materials Studied by Sierra Club

A training course currently being developed by the Sierra Club consists of a collection of options for learning about and doing something about toxic substances problems. The information can be used to get ideas for recruiting concerned people, choosing a project, developing a strategy for achieving its goals, and learning about particular toxic substance problems. The package consists of an organizer's handbook, facilitator's handbook, activities and readings on a range of subjects including pesticides, waste treatment, laws and regulations, enforcement, and human and environmental effects of toxic materials. Materials are designed for a do-it-yourself program for a citizens task force. Notice of availability can be obtained from:

Judith Kunofsky
Sierra Club
530 Bush Street
San Francisco, California 94108

Office of Consumer Affairs Produces Handbook

The U. S. Office of Consumer Affairs (USOCA) has been in existence since 1964. It has a major responsibility to provide the President and some federal agencies with advice and information regarding the interests of American consumers. The office encourages and assists in the development and implementation of consumer programs, coordinates and reviews policies and programs, seeks resolution of conflicts, and advises agencies of the effectiveness of their consumer programs.

USOCA has published a *Consumer's Resource Handbook* which tells consumers how to complain effectively and where to go for assistance at local, state, and federal levels. Single copies are available without charge by writing

Consumer Information Center, Dept 635H
Pueblo, Colorado 81009.

Also available from this address, on a limited basis, is *People Power, What Communities are Doing to Counter Inflation*. The book is divided into five sections. The section entitled "Basic Tools" provides the nuts and bolts of launching a community project. It contains helpful hints on organizing a group, raising funds, and attracting needed publicity. The next four sections, "Food," "Housing," "Energy," and "Health," profile the projects of dynamic groups around the country that have successfully cut costs or provided neighbors with essential services. Following each section is a list of resources of useful organizations and publications. These organizations are eager to help consumer groups nationwide by providing published materials, technical assistance, or funding. The publications include how-to manuals, directories, and newsletters The appendices contain information on federal programs that have provided assistance, an outline of the structure of the National Consumer Cooperative Bank, and a complete listing of the featured groups that contributed to the book.

Consumers can be placed on the mailing list to receive the monthly publication, *National Consumer Buying Alert*. It provides information about expected marketplace trends and conditions, along with timely buying tips. USCOA also publishes a twice-a-month newsletter, *Consumer Action Update*, for con-

sumer organizations and other special interest groups.

Consumer Education Resource Network Available

Today, as never before, consumer education professionals are faced with a dilemma—a vast amount of consumer education resources is available, yet it is often extremely difficult to locate needed materials and information

The CONSUMER EDUCATION RESOURCE NETWORK (CERN) is a national network designed to alleviate these problems by providing consumer educators with information about resources. CERN serves all individuals involved in the education of consumers This includes persons working with community service organizations, state and local education agencies, institutions of higher education, state and local public agencies, state and national education associations, national consumer organizations, and private industry.

CERN identifies and collects current information on all aspects of consumer education. A comprehensive on-site reference and referral library, composed of print and audiovisual materials, is maintained CERN has also developed a file of groups, organizations and individuals involved in consumer education activities. Technical assistance for program planning, implementation, and evaluation on all aspects of consumer education is provided by *linking* individuals who desire assistance with those persons or organizations that can provide such service Requests for information included in the CERN files can be made in person, by mail, or via a toll-free telephone line Reference and referral services are provided free of charge

For further information, contact:

L. Gayle Royer, Director
Consumer Education Resource Network
1555 Wilson Blvd., Suite 600
Rosslyn, VA 22209
toll free (800) 336-0223;
call collect (703) 522-4616, if calling from Virginia, Alaska, or Hawaii

Public Participation Materials Announced in Rie

This compilation of abstracts was obtained by searching the monthly publication, *Resources in Education* (RIE). The entries cited here are not intended to be exhaustive but are representative of the public participation documents currently in the ERIC data base. These documents may be purchased from the ERIC Document Reproduction Service (EDRS), PO Box 190, Arlington, VA 22210. Most of the listings are available [illegible]th in papercopy and in microfiche. [illegible]e documents are available in mic[illegible]fiche at any of the over 725 ERIC collections located throughout the United States and in some foreign countries

Readers of these abstracts will notice that cost information has been deleted This was done because there has recently been a change in price for both papercopy and microfiche. Readers interested in ordering documents should consult the most recent issue of *Resources in Education* for price information or should call (703-841-1212) or write EDRS to request this information

ED 106 628 EA 007 064
Booher, David E
Citizen Participation in Planning: Selected Interdisciplinary Bibliography. Exchange Bibliography No. 718.
Council of Planning Librarians, Monticello, Ill Pub Date Jan 75
Note—22p, Exchange Bibliography No 718
Available from—Council of Planning Librarians, P O Box 229, Monticello, Illinois 61856 ($2 00)
EDRS Price MF HC Plus POSTAGE
Descriptors—*Bibliographies, *Citizen Participation, *Interdisciplinary Approach *Planning *Public Policy

This bibliography is an inventory of relevant materials in planning and related disciplines It draws on research and theoretical perspectives from planning literature, economics, political science, psychology, public administration, and sociology Section one suggests references that offer general and theoretical perspectives useful in the development of research frameworks Section two contains selected references to empirical research and case studies that may provide useful background Section three lists references that focus on research in other countries (Author/MLF)

ED 111 697 UD 015 431
Edelman, Murray
The Language of Participation and the Language of Resistance.
Wisconsin Univ, Madison, Inst for Research on Poverty
Report No—IRP-DP-265-75
Pub Date Mar 75
Note—31p
EDRS Price MF HC
Descriptors—Authoritarianism *Citizen Participation, *Conflict Resolution, Decision Making, *Economically Disadvantaged, Institutionalized (Persons), Language Planning, *Language Styles, Lower Class, Participant Involvement, *Policy Formation, Socialization, Social Problems, Sociolinguistics

This paper holds that the outcomes of formal procedures between low-status groups and those in authority over them are largely symbolic or marginal in character Language and gestures are said to define the involvement of these groups with authorities either as joint participation in policy making or as conflict. Whether a political action is perceived as either a form of participation or as a form of conflict is said to depend on linguistic and gestural categorization This dichotomy is stated to hold far-reaching consequences for public support or opposition to regimes, and compliance with or resistance to rules The poor are seen to lack informal sanctions that confer influence, but can threaten elites by causing disorder-a political weapon which the poor renounce on becoming politicized Among the topics discussed are private versus public issues, politicization as co-option, influences versus ritual, the use of disorder, the structuring of perception through politicization, intense politicization, clarification and blurring of adversary relations, and antipolitics (Author/AM)

ED 126 863 SE 019 848
Citizen Action Guide to Energy Conservation.
Citizens Advisory Committee on Environmental Quality
Pub Date 74
Note—67p
Available from—Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 (Stock Number 4000-00300, $1 75. Discounts of 25% on orders of 100 or more copies)
EDRS Price MF HC
Descriptors—*Citizen Participation, *Conservation Education Depleted Resources, Energy, *Energy Conservation, *Environmental Education, Fuel Consumption, Natural Resources, *Resource Guides, Social Action

This book is concerned with educating citizen leaders and public officials on matters of transportation energy, industrial and electrical energy, and residential and commercial energy usage Also included are guidelines on developing a national energy conservation policy and mobilizing citizens for action in energy conservation concerns A glossary of terms, a short bibliography, and a listing of previous energy publications are at the end of the book (MA)

ED 135 680 SE 022 135
Wert, Jonathan M Magnoli, Michael A
Finding Solutions to Environmental Problems: A Process Guide.
Mobile County Public Schools, Ala
Pub Date 76
Note—31p, Not available in hard copy due to light and broken type throughout original document. This guide was developed in the Environmental Education Section, Mobile County Public Schools
Available from—Dr Michael A Magnoli, Coordinator, Environmental Education, Mobile County Public Schools, P O Box 1327, Mobile, Alabama 36601 (free)
EDRS Price MF-Plus Postage. HC Not Available from EDRS.
Descriptors—*Citizen Participation, *Environment, Environmental Education, Higher Education, Manuals, Problem Solving, Reference Materials Secondary Education

This guide is an attempt to provide a workable methodology for helping college students and citizen groups to identify the most pressing environmental problems in their communities and to find solutions to them With some modification, it can also be used by high school students who are interested in independent or team studies The monograph contains sections on (1) problem-focused environmental education, (2) suggestions regarding problem solving (3) suggestions for collecting and analyzing data or information, and (4) three projects for implementation (RH)

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A JOINT PROJECT OF THE NATIONAL INSTITUTE OF EDUCATION and THE OHIO STATE UNIVERSITY

This newsletter was prepared pursuant to a contract with the National Institute of Education, U S. Department of Education Contractors undertaking such projects under government sponsorship are encouraged to express freely their judgment in professional and technical matters Points of view or opinions, however, do not necessarily represent the official views or opinions of the National Institute of Education

Patricia E Blosser
Bulletin Editor

ED 151 286 SO 010 764

Citizen Participation.

Community Services Administration (DHEW), Washington, D C

Pub Date 7 Jan 78

Note—147p., Table on page 131 may not reproduce clearly due to small type size of original document

EDRS Price MF-HC Plus Postage.

Descriptors—Administrative Policy, Advisory Committees, Bibliographies, *Citizen Participation, *Citizen Role, Citizenship Responsibility, Democracy, Evaluation Criteria, *Federal Government, *Federal Programs, Glossaries, Laws, Local Government, *Program Descriptions, Public Officials, Public Opinion, Public Policy, Revenue Sharing, State Government

Identifiers—Federal Register

This booklet identifies citizen participation requirements for more than 300 federally assisted programs administered by 18 departments, agencies, and commissions It has been published in response to the government's desire to assist citizens in learning how, when, and where to go to participate in and influence the governmental decisions which affect their lives, as well as to improve government efficiency at all levels. The booklet is also designed to assist state and local officials in understanding the mandated requirements for citizen participation by providing a summary of those requirements. Each federal program is listed by its authorizing agency, is designated by title and number assigned to it in the Catalog of Federal Domestic Assistance; contains a program description and describes the requirements for citizen participation. Agencies listed include ACTION, Departments of Agriculture, Commerce, HEW, Housing and Urban Development, Interior, Justice, Transportation, and Labor, Environmental Protection Agency, National Science Foundation, and others Use of the Federal Register and consultation with the responsible agency are recommended Also included are samples of frequently occurring problems and possible solutions for bringing about affective citizen participation, techniques and tools to enhance citizen involvement, plus suggestions for evaluating the process A glossary and bibliography conclude the booklet (Author/JK)

ED 155 166 SO 010 931

How Will America Grow? A Citizen Guide to Land-Use Planning.

Citizens Advisory Committee on Environmental Quality

Pub Date Apr 76

Note—42p.; Maps and drawings may not reproduce clearly due to poor legibility or small type size in original document.

Available from—Superintendent of Documents, U S Government Printing Office, Washington, D C 20402 (Stock No. 040-000-00347-9, $1 00 paperbound, quantity discounts available)

EDRS Price MF/HC Plus Postage.

Descriptors—*Action Programs (Community), Changing Attitudes *Citizen Participation, Citizenship Responsibility, Community Action, Community Involvement, Cooperative Planning, *Environmental Education, Environmental Influences, Futures (of Society), *Guidelines, Information Utilization, *Land Use, Policy Formation, Public Policy

Citizens are encouraged to learn about and become involved in land use and growth issues in their communities. Intended as a follow-up of an earlier report by the Committee's Task Force on Land Use and Urban Growth which outlined philosophical, legal, and policy aspects of land-use planning, the document suggests planning guidelines for citizen action groups and decision makers at all levels of government The document is presented in five chapters Chapter I suggests that only major citizen efforts can channel growth in a positive way and counteract the out-moded American ideal of growth for growth's sake Chapter II introduces key factors in land use planning These include comprehensive land-use master plans, cost/benefit analyses, environmental impact statements, zoning, subdivision regulations, planned unit development, preemptive purchasing, and land banking Chapter III explains how to make a land use inventory of a community's assets and liabilities Chapter IV outlines major issues to consider when deciding how to use a parcel of land These include agriculture, economic development, energy requirements, flood plain use, housing, open space, and transportation The final chapter provides information for use by community associations as they organize for action, draw up land-use planning agendas, interact with decision makers, and implement land use goals (Author/DB)

ED 157 512 IR 006 018

Patrick, John J Remy, Richard C

Essential Learning Skills in the Education of Citizens.

Agency for Instructional Television, Bloomington, Ind

Spons Agency—EXXON Corp , New York, N Y

Pub Date 77

Note—36p , The Essential Learning Skills Television Project. Background Paper

EDRS Price MF Plus Postage. HC Not Available from EDRS.

Descriptors—*Basic Skills, *Citizenship, Criteria, *Curriculum Design, Daily Living Skills, *Decision Making Skills, *Educational Planning, Education Strategies, Educational Television, *Intermediate Grades, Lesson Plans

Five criteria derived from a original conception of basic education are used to appraise The Essential Learning Skills Television Project and to guide the proposal of ideas to strengthen the project It is assumed that to prepare students to cope with the challenges of daily living and citizenship, curricula must stress acquisition of skills in decision-making, i e , making, judging, and influencing decisions Two kinds of decisions faced by citizens are featured—decisions about factual claims, and decisions about group governance Factual decisions may require gathering and evaluating information to choose between competing claims Decisions about group governance may require use of both facts and value judgments A framework to guide teaching and learning of these skills is presented Instructional objectives, teaching procedures, and sample lessons are formulated in terms of the decision-making framework (Author/VT)

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Information Bulletin

No. 2, 1981

PROJECT SYNTHESIS

Editor's Comments

This issue of the ERIC/SMEAC information bulletin is devoted to a review of the report of Project Synthesis which appeared as Volume III of the "What Research Says to the Science Teacher" (SE 033 914) published by the National Science Teachers Association with funding from the ERIC Clearinghouse for Science, Mathematics and Environmental Education. Project Synthesis was the title given to grant awarded to Norris Harms at the University of Colorado to synthesize and to interpret the information found in the three NSF status studies and the reports from the National Assessment of Educational Progress.

The status studies related to the literature review, *The Status of Pre-College Science, Mathematics, and Social Studies Education: 1955-1965, Volume I: Science Education* (ED 153 876); *Volume II: Mathematics Education* (ED 153 878); *Volume III: Social Science Education* (ED 153 880); the national survey, *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education* (ED 152 565); and the case studies, *Case Studies in Science Education Volume I: The Case Reports* (ED 166 058) and *Volume II: Design, Overview and General Findings* (ED 166 059). Readers wishing the highlights of these three studies are referred to the summary volume prepared by the directors of the three studies, *The Status of Pre-College Science, Mathematics, and Social Studies Educational Practices in U.S. Schools: An Overview and Summaries of Three Studies* by Stanley L. Helgeson, Robert E. Stake, and Iris E. Weiss et al (ED 166 034).

These materials were supplemented with information from the science assessments carried out by the National Assessment of Educational Progress, by a review of current science textbooks, and by some other analyses of the current situation in K-12 science.

The research procedure used by the five focus groups involved in Project Synthesis was a discrepancy model. In this model a desired state is set forth, followed by descriptions of the actual state of affairs. The analysis is focused on the identification of discrepancies between the desired state and the actual state. Once discrepancies are identified, recommendations for future action can be made.

Organization and Procedures

Five separate focus groups analyzed and interpreted data from the perspectives of (1) the biological sciences, (2) physical sciences (including the earth sciences), (3) inquiry, (4) science/technology and society, and (5) elementary school science. Although these groups worked independently, they operated within a common framework; namely, a set of broad goal clusters and activities separated into three sequential phases.

The four broad goal clusters identified for use in discussing major emphases in science education related to (1) the individual, (2) society, (3) academic preparation, and (4) career chocie.

GOAL CLUSTER I — Personal Needs
Science Education should prepare individuals to utilize science for improving their own lives and for coping with an increasingly technological world.

GOAL CLUSTER II — Societal Issues
Science Education should produce informed citizens prepared to deal responsibly with science-related societal issues.

GOAL CLUSTER III — Academic Preparation
Science Education should allow students who are likely to pursue science academically as well as professionally to acquire the academic knowledge appropriate to their needs.

GOAL CLUSTER IV — Career Education/Awareness
Science Education should give all students an awareness of the nature and scope of a wide variety of science and technology-related careers open to students of varying aptitudes and interests. (p-7-8)

The project was divided into three phases to answer three broad questions concerning the desired and actual states in science education and discrepancies between them:

What are the desired states in science education?

What are the actual states in science education?

Are there discrepancies between the actual and desired states?

Phase 1 — desired states in science education. The task during this phase was to formulate descriptions, in operational terms, of what would be expected in science education if the four goal clusters were indeed being achieved. Attention was given to such areas as desired learning outcomes, curricula, program utilization, course offerings, enrollments, teacher characteristics, instructional strategies, and evaluation concerns.

Phase 2 — actual states in science education. The emphasis during this phase was to determine the status of science education by analyzing data bases with respect, but not limited, to the four goal clusters and other areas defined during the first phase.

Phase 3 — discrepancies between desired and actual states. Discrepancies were identified and studied during this phase In addition, casual factors which appeared to perpetuate problems in science education were identified, together with alternative modes for solving the problems.

Sources of Data

The major sources of data used by the focus groups of *Project Synthesis* were of three kinds.

The NSF studies provided data from three different perspectives; namely, a survey of the literature, a survey of personnel, and case studies. *The Status of Pre-College Science, Mathematics, and Social Science Education: 1955-1975. Volume I: Science Education* (Helgeson, et al., 1977) presented information from published and unpublished literature focusing on practices in schools, instructional materials, teacher education, administrative/financial control, and needs in K-12 science. *Report of the 1977 Survey of Science, Mathematics, and Social Studies Education* (Weiss, 1978) summarized information obtained from questionnaires sent during a national survey to teachers, administrators, supervisors, and other school personnel. These questionnaires requested information concerning curricula, course offerings teaching assignments, support services, and demographic information about teaching practices. *Case Studies in Science Education* (Stake, Easley, et al., 1978) sum-

marized data from in-depth analyses of reports prepared after extended on-site visits to 11 schools, each school representing a different type of community These three NSF studies, then, provided a wealth of information concerning what the literature, professionals, and professional observers revealed about the state of K-12 science education

The third NAEP assessment of science education (1978) provided data on the knowledge, skills, attitudes, and educational experiences from a sample of nine-, thirteen-, and seventeen-year-olds, as well as for adults.

During the course of the project, the data base was expanded to include (1) journal articles dealing specifically with the goals and objectives of science education, (2) widely used science textbooks, and (3) the knowledge and expertise of those working on the project

General Conclusions

Desired States. Each focus group formulated desired states of science education congruent with its discipline However, some generalizations can be made concerning this activity. Although it is somewhat difficult to determine broad goals, once they have been formulated, it is possible to describe specific student outcomes and curricular characteristics congruent with these goals. Different goals necessarily translate into different objectives for course offerings, curriculum materials, teacher characteristics, and instructional strategies. In addition, translating the goals into operational terms permits an evaluation of how well science education practices and programs meet each of the various goals.

Actual States. Four general conclusions were reached which appeared to cut across curricula, courses, enrollments, teacher characteristics, classroom practices, and student outcomes

1 Science education is given a relatively low status and, hence, a lack of general support at all educational levels when compared with mathematics, language arts, and social studies.

2 Science textbooks play a crucial role in science education. It was estimated that between 90-95% of 12,000 teachers surveyed use textbooks 90% of the time as the major curriculum material.

3 The goal of academic preparation dominated all aspects of science education, especially in the most widely used textbooks. Goals relating to personal uses of science in daily life, to general scientific literacy decision-making practices, and to career awareness and planning are either totally ignored or mentioned in passing.

4. Classroom teachers are the key decision-makers in terms of course context, textbook selection, instructional strategies, teaching style, selection of tests, assignment of grades, etc. Because they are key decision-makers, they in fact determine the goals espoused by science education.

Discrepancies and Implications. Major discrepancies exist between the desired and actual states in science education. Some generalizations reported by all the focus groups are:

1. The major goal in science education as practiced in schools is that of academic preparation. However, the three other goals should be given equal importance at all educational levels so that the majority of students can (1) use science in their daily lives, (2) engage in intelligent decision-making relative to science/society issues, and (3) make decisions about selecting (or not selecting) scientific or technological careers. These goals should be fostered in addition to preparing students interested in taking advanced coursework in science.

2. New programs would have to be developed to achieve all four goals The development, of necessity, would require major attitudinal changes in the rethinking of the goals and priorities in science education among teachers, principals, parents, and other decision-makers at all educational levels.
Elementary Level — The major change to be fostered among elementary personnel and parents is the realization that science is a basic. Furthermore, local support systems would be necessary to introduce programs which require little effort but would have lasting impact.
Junior High/Middle School Level — The primary goal at this level would be general education programs rather than academic preparation for future coursework in science These programs would address issues and topics relating to individual, societal, and career awareness/choice needs. In addition,
a. The emphasis in the laboratory would be changed from rediscovering scientific concepts to investigations into implications of scientific knowledge and technological development on problems faced by the individal and by society in general.
b. Problem - solving and decision - making skills would receive increased attention.
c. Basic scientific knowledge, concepts, and principles, as well as inquiry strategies, although essential to the curriculum, would be selected in relation to all four goals, and not specifically because of their importance as prerequisites for advanced coursework.
High School Level — Because most students would still take biology as part of their high school program in grades 9 or 10, biological topics would be presented in a personal and societal context, emphasizing the results of the human endeavor on the world, human dependence on the environment, and the responsibility for preserving the world In other words, the human species would be the focus of the high school biology program. In addition,
a. College-preparation courses in advanced biology, chemistry, and physics would still be offered at the high school level However, to prepare responsible scientists, engineers, and technicians, relationships between science/technology and human endeavors would be emphasized, in addition to important scientific knowledge, concepts, and principles
b. New courses stressing applications from the physical and earth sciences to individual and societal needs would be developed to attract all students These would not be "watered down," or "Mickey Mouse" courses, but science/technology courses emphasizing personal, societal, and academic goals

3 A greater emphasis in program development would be placed on the full spectrum of cognitive levels. Acquisition of discrete facts and isolated principles for their own sake is not congruent with the basic goals Problem-solving and decision-making in personal and social contexts require not only applying knowledge, but also interpreting data, analyzing complex problems. and evaluating alternative situations involving multiple variables.

4 Career choice/awareness would be incorporated into all programs at all levels. Information concerning specific careers would be presented in textbooks. Science topics would be approached from the point of view of how and by whom knowledge is acquired and used. Opportunities would be provided to talk with individuals in specific careers, for engaging in simulations, on-the-job work experiences, volunteer work, etc

5 Certain teacher characteristics were identified as being important to the implementation of the four broad goals in science education. Among these characteristics are.
a. Recognizing the individual needs of students, especially when determining course content and instructional strategies, encouraging indi-

vidual projects; determining ways science and technology are applicable to everyday life.

b Understanding interrelationships between science/technology/societal problems and issues; fostering the inquiry process in making decisions about important issues.

c Understanding what knowledge is fundamental and what skills and processes are needed for later work; developing a conceptual framework for interdisciplinary and multidisciplinary approaches, using multimedia approaches and laboratory investigations reflecting scientific and technological methodology

d Recognizing the importance of career planning and fostering a sense of responsibility for helping students plan their careers, introducing career awareness into classroom topics in the most natural way as possible.

6 Some general steps that teachers can take in developing new educational programs and classroom practices in science education are.

a. Determination of broad goals for science education.

b. Identification of student outcomes which are important to achieve each of these goals.

c Identification of course offerings, textbook characteristics, classroom practices, and testing procedures which will produce and evaluate important student outcomes.

d. Comparison of the "ideal curriculum" with the current curriculum

e. Decide on a course of action
Developing a new teacher competencies to deal with changing needs
Accepting the responsibility of educational leadership

Since classroom teachers make the most important curriculum decisions (including what courses are offered, selection of textbooks, and developing/implementing instructional strategies), if they are convinced that current goals of science education are not congruent with the needs of their students, they are in the best position not only to establish new goals but also to implement them. In this rapidly advancing technological society, this is an awesome responsibility.

INDIVIDUAL FOCUS GROUP REPORTS

The remainder of this newsletter is devoted to summarizing the individual focus group reports. Each summary will be divided into three sections reflecting the desired states, actual states, and discrepancies/recommendations unique to the specific groups.

Biology Education

Desired States The major thrust in a desired biology program would be the use of biological knowledge, concepts, and principles in terms of individual needs, social needs, and career awareness. The change in emphasis from biology courses organized to illustrate the structure of the discipline to courses organized to enhance a better understanding of oneself and others results from advances in a number of areas, including

1. new theoretical insights (sociobiology),
2. new technologies for research (recombinant DNA),
3. new interdisciplinary perspectives (biophysics, biochemistry, environmental psychology, human ecology),
4. new concerns about biology and human activities (bioethics, human engineering),
5. a new awareness that although human beings evolved by means of natural laws, survival is now under control of the human species itself, and,
6. new insights into biology as a link between the natural and social sciences giving rise to new cross-disciplinary perspectives (social-biology, human ecology, ecological psychology) directed toward comprehending human life as a whole (p 12-13)

Actual states Goals — The major goals of biology education during the 1955-1975 period focused on biology vocabulary and narrow course objectives (i.e., statements of what knowledge is to be learned) and not on the goals of conceptual schemes and inquiry processes promulgated by the science course improvement projects developed during this period. Biology curricula were determined by the goals and objectives of textbooks: in particular, three textbooks used in approximately two-thirds of the biology classes in this country, namely, *Modern Biology, Biological Sciences Curriculum Study (BSCS)* "Yellow," and *BSCS* "Green" Although each of these textbooks has individual merit in terms of the desired states of biology education, they nevertheless in terms of their stated objectives, tend to represent the discipline itself rather than fostering an understanding of relationships between subject matter and the individual in a societal setting

Two current issues, instructional programs and practices, the "back-to-basics" movement and bio-social issues, have resulted in the modification of many biology programs. The response of biology to the back-to-basics movement can be considered to be a negative consequence, since the result has been to have students memorize those discrete facts considered to be "basic" to an understanding of biology However, the nationwide attention given to issues such as bioengineering, energy, biomass, etc., has resulted in the development of "mini-courses" and modules on these topics. Unfortunately, these same topics are relegated to the social studies curriculum in many schools.

Instructional programs were determined by examining the three textbooks previously mentioned.. Basic information is presented in terms of the morphology and physiology of plants and animals Criteria used to select course content appear to be

1 presenting a sampling of information from the various disciplines of the biological sciences (e.g., botany, zoology, genetics, etc),
2 giving students experiences in the processes of scientific inquiry (e.g., observing, recording data, etc.),
3 fostering the development of scientific attitudes (e g, seeing the importance of critical thinking, willingness to admit errors, etc.), and
4 developing inquiry skills

The emphasis in the junior high/middle school life science programs is on facts, that is, knowing the names of plant and animal parts, etc. Growing bean seeds and observing the parts of plants were typical of the laboratory activities at this level Little or no emphasis was placed on inquiry skills

Biology teachers generally agreed that professional publications, professional meetings, and other teachers were the best sources of information about new biology programs.

Although approximately 36,000 teachers with a major in biology teach two or more biology classes each day, approximately 15,000 to 20,000 are teaching biology without a major in this subject Many junior high/middle school science teachers are required to teach non-science courses in addition to their science specialty Although most biology teachers are perceived positively by their students, teachers perceive themselves as losing status in their buildings and under constant pressure to perform numerous non-teaching duties.

Pre-service education in biology generally occurs in two phases; general education requirements and professional training Although well-prepared in biology, most biology teachers lack necessary background in chemistry, physics, and mathematics. Biology courses they take are the same courses taken by students preparing for advanced graduate work. Since inquiry strategies are rarely experienced at the college level, these are rarely used in teaching biology at the high school level.

Most biology teachers gave negative ratings to school-sponsored, in-service programs, while those who attended NSF-sponsored summer or academic

(2) attention to directions is essential,
(3) the most reliable learning will occur when assignments are properly carried out, and
(4) frequent testing is important (p 44-45).

Some teachers appear to stress the socialization process and subject matter as a means to this end, while others (the subject matter specialists) treat socialization as a means to effective learning of the subject matter

In actual classroom practice, inquiry and experience-based approaches are shunned and heavy reliance is placed on the textbook, which is considered to be "the authority" In addition, many teachers are convinced that learning from printed material is a basic skill needed by students.

The major characteristics of students were found to be a lack of motivation and poor reading ability (which may be related to grading practices) Although many students believe that science/technology can help solve such problems as pollution, many do not realize that science/technology can cause problems as well, indicating that the goal of societal needs is given little attention in current curricula.

Discrepancies/recommendations. The major goal in physical science instruction appears to be the acquisition of basic knowledge In addition to this narrow goal, the textbook is the authority, while laboratory work and inquiry processes are lacking. As a result little attention is given to applications and problem-solving skills. Also the physical sciences are not valued in the education of all students. Therefore, the following recommendations for physical science education are made

1. Goals should be broadened to reflect the personal and societal needs and career awareness/preparation, as well as the acquisition of fundamental knowledge at all educational levels.

2 Programs reflecting these goals should be available for all students This would involve creating new programs and modifying existing programs

3 Pre- and in-service teacher education programs should emphasize not only relevant physical science content, but also higher cognitive levels and all four goal clusters, together the means of attaining the goals for all students, not only the academically inclined.

4. Tests (both standardized and teacher-prepared) need to be developed which reflect the four broad goal clusters.

Inquiry in School Science

The domain of inquiry is divided into three areas (1) general inquiry processes (including, among others, problem-solving, decision-making, and making use of evidence); (2) science process skills (including, among others, the processes of observing, measuring, and interpreting data); and (3) the nature of scientific inquiry, which is concerned with the validity of knowledge (knowledge is tentative, the result of human efforts, and affected by the context in which it occurs)

The desired and actual states and discrepancies are discussed in terms of context, transactions, and outcomes Context refers to the conditions which exist prior to learning, transactions represent the actual learning process, and outcomes are the results of the transactions which occurred in a certain context.

Desired states Context the context of effective inquiry teaching is related to three factors, i.e, teachers who value inquiry and encourage inquiry in others, curricula containing statements fostering inquiry, and classrooms arranged to stimulate student investigations in inquiry processes

Transactions: A variety of methods should be used to foster inquiry, including, discussions, lectures, laboratory investigations, and debates The classroom atmosphere should be conducive to inquiry teaching and learning where students, for example, can ask questions, engage in conversations, and participate in large and small group activities as well as work on individual projects. Evaluation should assess inquiry processes as well as content.

Outcomes Typical outcomes characteri[illegible] of the desired states and related to the four broad goal clusters would include, among others,

General Inquiry Processes—

Personal Needs — Uses evidence from a [illegible] of sources to make decisions about personal health problems

Societal Issues — Decides what is and what is not scientific evidence in a simple science-related social issue.

Knowledge — Can grasp the meaning of simple scientific statements such that he or she would know what counts as evidence for and against it. (Example knows that statement "Wood floats in water" implies that "wood is less dense than water.")

Careers — Decides what the main issues of selecting a science career are.

Science Process Skills—

Personal Needs — Measures accurately such body symptoms as blood pressure.

Societal Issues — Can measure personal actions that have influence on society, e.g., monitors through measuring techniques the heat loss of a home.

Knowledge — Observes and describes objects and phenomena (including change) using appropriate language

Careers — Participates in a variety of observational and measurement activities to sufficiently examine the potential and interest to them for a career in science.

Nature of Scientific Inquiry—

Personal Needs — Recognizes that the relevance of scientific knowledge is likely to be limited to its own domain of inquiry

Societal Issues — Anticipates that scientific knowledge related to societal issues may change and will therefore demand a different point of view to use the altered knowledge

Knowledge — Cites examples of earlier and current scientific explanations which have been, or are being, altered

Careers — Recognizes the primary need to be curious about natural phonomena in order to be suitable for a science vocation

Actual states. Context: In terms of inquiry teaching, goal statements relating to inquiry processes could be found at local and state levels and teachers considered inquiry skills to be important. However, teachers felt that they should be teaching facts which can be measured on tests, the basics, structure, and the work ethic

Teachers, for the most part, found inquiry approaches difficult to manage, especially in classrooms with discipline problems In addition, many felt that inquiry did not "work" for all students Lack of preparation in college courses appeared to be a factor fostering the lack of inquiry teaching in schools. Preparing students for advanced courses and socialization appeared to be the two most important factors discouraging inquiry strategies

Transactions: Although inquiry strategies are used in some schools, the overall finding is that inquiry strategies are not used or valued. For example, 30% of elementary schools used NSF-supported inquiry materials but 70% did not. In addition, pressures such as teaching the basics, mainstreaming, etc, did not leave time for true inquiry strategies.

Outcomes. Although students appeared to have some knowledge of the processes and nature of scientific inquiry, a real understanding of the processes was not exhibited Students generally thought science was done by someone else and could not be incorporated into their own thinking. Although many realized that scientists change their ideas in light of new evidence, they expressed an unwillingness to engage in the same process.

Discrepancies/recommendations. Inquiry in science education is not being achieved Although inquiry strategies are espoused by science educators, inquiry goals can be found at state/local levels, NSF materials are available, teachers graduate from NSF institutes/workshops, etc., little evidence of inquiry practices was seen in schools.

The following recommendation is made every expected student outcome with respect to inquiry in science education should be responsive to individual differences, personal goals and community wishes (p 67)

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When individual differences are considered, inquiry outcomes will not be beyond the developmental, intellectual, and/or personality capabilities of stu-

dents. Inquiry outcomes are responsive to personal goals when they do not result in a behavior which is incompatible to these goals, including choice of career direction

Central to this recommendation is the development of a "Student Profile for Inquiry Competencies." The profile would contain a goals component and a programmatic component. The former would contain a list of the inquiry-related competencies which the individual should develop throughout his/her schooling. This would give direction to the student's individual learning program. The latter would contain the kinds of experiences needed to develop the goals specific to the individual student. These experiences are really nothing new, but are the various instructional procedures and materials familiar to most science teachers, including specific courses fostering inquiry, self-instructional modules, minicourses, laboratory/field work, texts and other reading materials, and specific assessment instruments.

The inquiry focus group concluded their report by saying:

We are convinced that, in the present educational era, it is technically feasible to match each student's learning experiences to individual traits and needs. Planning for this kind of matching in the inquiry domain is particularly apt, because there are large variations in desirable inquiry-related outcomes for different students. Our stance is that all students should not be expected to attain competence in all inquiry-related outcomes which science educators (including ourselves) have advocated in the past For some students and in some school environments, it may be appropriate not to expect any inquiry-related outcomes at all. (p. 71)

Elementary School Science Education

The general view held by this focus group is that elementary school science should excite the children's natural curiosity, foster an interest in the students' world as well as in themselves, and provide opportunities to engage in scientific methodology.

Desired states. Content knowledge for elementary school students should not be a list of specific concepts or facts but should broadly sample all content areas. It should also support all four goal clusters (personal needs, societal issues, academic preparation, career education/awareness). Further, it should develop the processes of science and be of interest to students. The elementary school should not be viewed as the place to begin the development of detailed concepts in preparation for junior and senior high school. It should be a conceptually rich program in which students are introduced to exciting and important phenomena to be observed and analyzed, but it should not reflect a need to cover a syllabus of content in all science disciplines

Selected program characteristics would involve having students solve problems growing out of first-hand experiences, using an interdisciplinary approach, and selecting materials appropriate to specific age levels. Implementing the desired science program would include (1) science for all children, (2) teachers who are knowledgeable not only about science content but also children and the role science plays in enhancing their development, and (3) instructional strategies which aid in the development of questioning and evaluating skills and which foster cooperative activities while not neglecting individual differences. Appropriate facilities would also be needed to implement such a program, including a support system to supply teachers with appropriate materials, collecting them after use, and replacing consumable items.

Actual states. Students receive a very limited exposure (typically at the end of the school day) to science at the elementary level by teachers who have little expertise, interest, or training to teach science Equipment, when available, receives little or no use. Instructional strategies usually involve reading about science, memorizing facts from a text, or completing teacher-prepared work sheets.

Textbooks and programs used in elementary schools were examined because these materials represent the major determinants of student outcomes Three categories of published materials were examined. (1) frequently-used texts (2) NSF-funded materials and (3) "new generation" texts.

Comparisons of the three types of materials revealed strengths and weaknesses relating to the four broad goal clusters. For example, skill development was not emphasized in the frequently used texts, was high in the NSF texts, and high to low based on what program in the new generation texts was examined. Although no single program or category presented material equally well in all four areas, virtually all goal clusters can be met by selecting appropriate material from different texts.

In general, the NSF and "new generation" texts stressed interdisciplinary approaches, first-hand experiences, data-gathering skills, and how children learn, while traditional texts were ranked low to none when considering these characteristics.

Various factors appear to influence program dissemination and program adoption. It is suggested that the relative stability of science teaching during the past 25 years may be due to the fact that teachers have not heard about new programs. In general, NSF materials are used in schools where a principal or teacher has participated in an NSF institute. Factors such as lack of preparation in science content, pressure groups, desirability of inquiry, back-to-basics movement, amount of time necessary to prepare for and to teach science, as well as socialization (leading to an emphasis on extrinsic motivation, attention to directions, homework, and testing) all affect the potential adoption of elementary science programs

Teachers have also indicated that many barriers exist relating to the implementation of science programs, including

1. teachers do not like science or study it on their own,
2. there is a heavy reliance on the textbook,
3. there is a lack of time to adequately prepare for science activities,
4. teachers oftentimes do not hear about new science programs;
5. science supervisors are not available to help teachers,
6. there is a lack of paraprofessional help,
7. there is a lack of equipment, money to purchase same, and little or no storage space; and
8. lack of training in specific science areas

The lack of training in the scientific disciplines is probably the most important obstacle to the implementation of elementary school science programs (p. 86-88)

Discrepancies/recommendations. Student outcomes and program characteristics relating to the four goal clusters are not valued by parents, administrators, and most elementary school teachers. Ways must be found to make science education goals their goals Therefore, it is recommended that a clarification of the goals and priorities of these decision-makers is needed, as well as an identification of programs and instructional strategies congruent with these goals.

Many barriers (some real, others not) exist which prevent the implementation of science programs in elementary schools. It is suggested that if teachers are well prepared and science is valued, these teacher-perceived barriers will not prevail. Therefore, a determination of which barriers are real must be made. In addition, case studies should be made where science is taught effectively, where model science programs exist.

Elementary school teachers are not prepared to teach science content and for the most part do not value science; support must be given to universities and state, district, and local school levels to develop in-service programs. Funding should also be made available to identify and train resource/supervisory personnel at both the state and local levels.

Much time and effort have been devoted to developing elementary school science curricula. Time and effort should now be devoted to implementing them.

Interaction of Science, Technology, and Society in Secondary Schools

The science, technology, and society focus group spent considerable time in defining their domain. Science, technology, and society (STS) issues deal with considerations growing out of work in the science disciplines and also with concerns which originate from the society impacted by developments in science The group defined technology to include both hard technology — hardware developed for use by humans and soft technology — systems involved in the development and use of technological devices as well as the systems involved in solving problems in industry and society at large

Desired states. Eight specific areas of concern were identified and described as these related to the four goal clusters. These areas are Energy, Population, Human Engineering, Environmental Quality, Utilization of Natural Resources, National Defense and Space, Sociology of Science, and Effects of Technological Development.

Desired student outcomes were presented relative to the areas of concern as these areas intersected with the four goal clusters. Considerable space in the report was devoted to describing desired student outcomes by example (pages 96 through 105 contain this material)

This focus group desired that science education programs prepare individuals to utilize science for improving their own lives and coping with an increasingly technological world Citizens should also be prepared to utilize science to deal responsibly with science-related social issues. Science education programs should insure the continued development and application of scientific knowledge by maintaining a critical mass of fundamental scientific understanding in the American public Finally, the continued development and application of scientific knowledge should be insured by maintaining a continual supply of citizens with scientific expertise.

Actual states. The following points reflect the current status of teaching relative to science, technology, and society (STS) issues:

1. Teachers use the textbook not only for course content, but as the curriculum.

2. Little or no STS material is available in current texts In general the texts are concerned with theoretical and abstract material, with few practical applications.

3 Few courses meeting STS goals could be found. Although STS materials are available, they are not known to science teachers. In addition, where such courses are offered, they do not attract the elitists in the schools.

4. Courses to prepare high school science teachers reflect the science specialist approach. Preparation for teaching STS courses is almost nonexistent

5 In-service programs generally fall into the awareness category rather than as preparation for teaching STS. In general, in-service tends to involve improving teaching methods for specific context areas

6 NAEP findings indicate a very low level of STS knowledge, for example, while 12% of 17-year-olds knew that plastics come from petroleum, only 3% knew that the mortality rate of infants in the United Sttes is worse than that of most western European countries

STS topics for the most part are avoided in the science curriculum, in spite of the fact that our society is becoming more technologically oriented

Discrepancies/recommendations. Based on the discrepancies between the desired and actual states, 26 recommendations are addressed to school personnel, curriculum developers, educators of teachers, funding agencies and policy makers, and the general public (pp. 107-112) Some of these recommendations follow

STS materials should be reflected in all science areas in future texts Specific guidelines need to be developed to evaluate texts in terms of STS content Likewise, special publications, films, magazines, etc should be developed which present a wide variety of topics

Teachers should be encouraged to develop and use STS materials at appropriate places in their courses with the knowledge that state agencies and colleges will not only accept but also endorse teaching STS In addition, conferences and in-service programs for teachers should be held on STS curricula

Serious consideration should be given to the adoption of STS programs for all students Existing courses should be critically examined in order to replace obsolete material with STS material or to adapt STS material with little modification to the existing course.

STS should be integrated into the total school curriculum. For example, teachers from different areas (science, mathematics, English, social studies, etc.) could develop STS activities around a given topic

Clearinghouses should be established to include information and curriculum materials in the STS area Teachers should be given time and encouragement to examine these materials.

New courses on STS and technology education should be developed at the college level since the grade 7-12 curriculum tends to reflect the discipline approach of college as well as instruction (teachers teach as they were taught). These courses should not be limited to teacher preparation programs but should be offered by science, art, and engineering departments.

Time, effort, and money should be invested, not in developing materials per se, but in implementing activities: awareness activities, research activities, etc

Since technological education is rather new, it is suggested that campaigns be started to increase public awareness of technology's impact on human life In addition, certain areas need to be addressed by research activities, including the domain of technological education, and by research into the nature of the decision-making process which determines course offerings and content Since STS would most probably be an elective course at the secondary level, research should focus on the student who selects or rejects STS

Implications for Teachers

The discrepancy model used in Project Synthesis revealed the fact that the educational goals reflected by practices in science education appear to be extremely narrow as well as based on the erroneous assumption that most science students will go on to take considerable coursework leading to careers in science Present science education programs largely ignore the goals of preparation for citizen preparation to utilize science and technology-related societal issues, preparation to use science in everyday life, and preparation for making career choices in science-related fields

Some generalizations reflecting the concensus of all focus groups are

- At all levels, science education in general is given a relatively low priority when compared with the language arts, mathematics and social studies, and its status is declining This low priority results in a general lack of support for science in most school systems
- Textbooks play a dominant role in science instruction

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Patricia E Blosser
Bulletin Editor

- Of the four goal clusters, only the goals related to development of basic knowledge for academic preparation receive significant emphasis Goals related to personal use of science in everyday life, to scientific literacy for societal decision-making, and to career planning and decision-making are largely ignored
- Teachers make most of the important decisions about course content, text selection and instructional methods, and in so doing they determine the goals pursued by science education (p 114-118)

When the world of the 80's is compared with the world of the 60's, immense changes which impinge upon science teaching are evident There is no longer the push for, and the funding of, programs to prepare scientists and engineers Shortages of natural resources formerly taken for granted (energy, water, minerals, land and space) require citizens to view technological developments in new ways Along with an increased need to understand large national issues, there is an increasing need to understand the way science and technology affect people as individuals

Can science educators at all levels (K-college) shift goals, programs and practices from the current emphasis on academic preparation for science careers for a few students to an emphasis on preparing all students to grapple successfully with science and technology in their daily lives as well as participate knowledgeably in the important science-related decisions our country will have to make in the future? (p 119) Project Synthesis participants insist that science educators have a responsibility to rethink the goals of science education. New goals will require new programs Classroom teachers will have to think through their philosophy for teaching science and, no doubt, make some adjustments.

Persons interested in meeting this challenge are advised to follow a plan of action that closely parallels the one used in the early stages of Project Synthesis

1) Determine broad goals for science education
2) Identify student outcomes which are important to achieve each of these broad goals
3) Identify course offerings, textbook characteristics, classroom practices and testing procedures which will produce and evaluate important student outcomes
4) Compare the "ideal curriculum" with the current curriculum
5) Decide on a course of action
   a) Develop new teacher competencies to deal with changing needs
   b) Accept the responsibility of educational leadership

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Information Bulletin

No. 3, 1981

Problem Solving Goals: Cognitive and Affective

Editor's Comments

The third issue of the 1981 series of information bulletins produced by personnel of the ERIC Clearinghouse for Science, Mathematics, and Environmental Education is focused on the topic of problem solving, which was also discussed in the second mathematics education fact sheet for 1981. The fact that two documents are devoted to the same topic serves to emphasize its importance.

The material in this information bulletin was based, in large part, on *Problem Solving . . . A Basic Mathematics Goal*, written by Steven P. Meiring. This information bulletin was prepared by Dr. Jon L. Higgins, Faculty Research Associate - Mathematics Education, ERIC/SMEAC.

Computational proficiency and numerical concept development have long been recognized as basic skill goals of elementary and middle school mathematics programs. Though mentioned in most curriculum descriptions, problem solving has seldom been pursued with the same immediacy or emphasis as have these other two goals. Characteristically, problem solving has been perceived as a by-product of other learning activities that are considered to be of greater value.

Despite this incidental treatment of problem solving, there have been many recent calls to place more emphasis on problem solving in the mathematics curriculum. When the National Council of Supervisors of Mathematics developed a Postition Paper on Basic Mathematical Skills in 1977, problem solving headed the list. This group noted that "learning to solve problems is the principal reason for studying mathematics" (NCSM, 1977, p. 2)

In *An Agenda for Action: Recommendatons for School Mathematics of the 1980's*, the National Council of Teachers of Mathematics proposed that "Problem solving must be the focus of school mathematics in the 1980's" (NCTM, 1980). Thus it was suggested that:

—The mathematics curriculum should be organized around problem solving

—The definition and language of problem solving in mathematics should be developed and expanded to include a broad range of strategies, processes, and modes of presentation that encompass the full potential of mathematical applications.

—Mathematics teachers should create classroom environments in which problem solving can flourish.

—Appropriate curricular materials to teach problem solving should be developed for all grade levels.

—Mathematics programs of the 1980's should involve students in problem solving by presenting applications at all grade levels.

—Researchers and funding agencies should give priority in the 1980's to investigations into the nature of problem solving and to effective ways to develop problem solvers (pp. 2-5).

Data from the Priorities in School Mathematics (PRISM) Project (NCTM, 1981) indicated that national samples of teachers, parents, and others agreed that problem solving should be given the highest priority for consideration in the 1980's.

Placement of Problem Solving in the Curriculum

Problem solving is perceived by some educatiors as a higher intellectual activity that should be deferred until fundamental concepts and computational skills are well in place. Believing their responsibilities to involve the development of more fundamental skills, they leave problem solving instruction for others at a later time.

But problem solving is a natural learning activity that every preschool child has already experienced. It begins as soon as an infant becomes aware of himself and his environment, develops some need, and tries to satisfy it. Children soon discover a cause and effect relationship between their actions and the satisfaction of their immediate needs. Some actions produce satisfactory results. Some do not. However, each experience with attempting to solve a problem adds to the infant's understanding and growth.

As the infant develops into a young child, he/she uses additional information, capabilities, and knowledge to expand his/her range of responses to problems. Utilizing his/her growing skills, the young learner is able to explore new situations that generate still further problems for mastery. In the process of conquering these new problems, the information and experience gained through each solution become part of this growing problem solving capability, subtly reshaping his/her existing knowledge and skills through its acquisition.

A good educational program builds on the natural, informal methods the child brings to school. It provides a balance of skill, concept, and problem solving development similar to the kind of learning the child has experienced prior to coming to school. No aspect of learning is sacrificed, postponed, or neglected. All requisites for the application of learning are pursued concurrently, each reinforcing and strengthening the other. Skills and concepts are applied in problem solving, and problem solving provides a means to practice skills and strengthen content understandings.

Problem solving thereby becomes the responsibility of every teacher K-12. To ascribe a prerequisite status to problem solving is to interrupt the natural mode of learning and to run the risk that some children will never have the formal opportunity to participate in problem solving development because they have not achieved other goals.

Cognitive Considerations of Problem Solving

Students should be exposed to a variety of problem solving techniques, strategies, and modes of thinking as part of a planned and sequenced set of activities. At different grade levels, particular problem solving skills should be formally introduced and practiced. The key to a total problem solving curriculum is to give a skill particular emphasis and identification as a problem solving tool at a particular grade level. Thereafter, it will be practiced and used in subsequent grades as a problem solving skill rather than as a good thing to try, selected by happenstance. Planning a scope and sequence listing of problem solving processes and skills will assure that students are exposed to a range of such

procedures, have an opportunity to practice them as problem solving tools, and avoid the likelihood of hit-or-miss, incidental development of such important learning outcomes.

In *Problem Solving . . . A Basic Mathematics Goal*, (1980) Meiring lists 44 problem solving skills, and suggests grade level placement as well as sequence for introducing these skills in the mathematics curriculum. The following discussion is adapted from his list:

Kindergarten. Children can respond to problems that are posed by pictures. Support skills of sorting according to specified attributes and one-to-one matching should be developed and practiced. Problem solving skills using manipulatives to answer picture problems can be taught.

Grade One. Problems involving classification and requiring matching should be introduced. The support skills of collecting data, recording of data by tallying, and data and/or pattern observation should be developed. First graders should develop skills of sequencing picture problems, interpreting given picture problems, and making up problems from pictures

Grade Two. Problems without numbers, as well as problems involving number patterns and sequences should be introduced. Second graders can learn to complete a pattern or sequence, use rulers for measuring, record data, and write simple number sentences from story problems. Problem solving skills such as identifying given information, stating what is to be found, and acting out problem situations should be developed.

Grade Three. Children in grade three should deal with problems with single-step solutions, as well as problems that have more than one solution. Problems can be introduced that require careful reading and following of directions. Students may write problems for other students, involving not only real life situations but including fantasy and games. Reading and interpreting simple tables, bar graphs, and calendars should be developed as support skills. Children can learn to read and use a balance and can use a ruler to draw line segments and plane figures. Several problem-solving skills should be developed. Third graders should be able to restate a problem in their own words, look for patterns, and use simple models. These models may aid in choosing the correct operation or operations involved in the problem.

Grade Four. Problems requiring the interpretation of charts, graphs, or maps and that involve listing or drawing can be introduced at this level. Support skills involving sorting and organizing of data and construction of tables, charts, and graphs can be developed. The technique of guessing and checking can be introduced, giving practice in using a replacement set in an open mathematical sentence. In addition, determining the reasonability of an answer as well as estimating can be introduced as problem solving skills. Problems that involve personalized answers that can vary from child to child can help focus on the reasonableness of results. The use of drawings, figures, and graphs to solve problems should be taught.

Grade Five. Fifth graders can deal with problems containing superfluous information or that have no solution. Problems with multistep solutions may be introduced. These children should learn to choose and use a formula, as well as to round results where appropriate. They can locate points on a number line or coordinate system and use a variety of measuring devices. Problem solving skills involving the identification of wanted, given, and needed information can be practiced. Recording outcomes of events and accounting for all possibilities can be used to solve problems. Appropriate open sentences can be written, and the solution can be checked.

Grade Six. Problems that require the use of formulas may be introduced, as well as problems that utilize exploration and discovery. Problem situations that give insufficient information can also be introduced. Students may be expected to use non-text resources to find needed information. They may use simple constructions using compass, protractor, and rulers and may read and construct scale drawings. The use of flowcharts to list procedures and alternatives may be developed as a support skill to problem solving. The selection of appropriate notation and/or application of formulas may be developed as problem solving skills. Students should also learn to work backwards through a problem to determine appropriate procedures.

Grade Seven. Mathematical problems involving real world applications are accessible to students in grade seven. They should learn to handle problems that require open-ended exploration as well as estimation and approximation. The introduction of variables, and the selection of an appropriate variable to represent an unknown quantity are new support skills that can be used. Students should be able to use these skills to translate a problem into a mathematical sentence. Identifying and solving a similar or simpler problem can be developed as a technique for analyzing more complex problems. Students should also learn to identify subgoals and processes that would be helpful in reaching larger goals. lternate problem solutions should be studied and discussed.

Grade Eight. Problems involving deductive and inductive reasoning can be introduced at this level. Sample solutions involving faulty logic or false inference can be studied. Support skills for eighth graders include the solving of simple linear equations as well as determining the uniqueness of the solution. They should also practice determining precision of results. Checking for hidden assumptions can be developed as a problem solving skill, as well as generalizing from specific situations. Eighth graders can begin to interpret problems from different points of view, and use changed points of view as problem solving techniques.

Grades Nine and Ten. Ninth and tenth graders can investigate general problem situations where the problem itself must be defined and delimited. They may make and test hypotheses or use counterexamples to construct arguments. Understanding of necessary and sufficient conditions may be developed. They can check both problem statements and solutions for the misuse of data and can determine both the uniqueness and precision of solutions.

Related Skills from Other Disciplines

Many of the elements described in a problem solving curriculum for mathematics are common to other disciplines. Just as problem solving attempts to integrate knowledge in mathematics from several sources and apply that knowledge to new situations, we should view the similar need of articulating problem solving objectives across disciplines. In the elementary grades, positive reinforcement and transfer can occur through indication of how a mathematical idea is useful or related to a situation in science. Recognizing that "truth in advertising" discussions in social studies utilize similar reasoning and thinking skills to those studied in mathematics will have a similar positive effect. In grades where departmentalization or specialization of teaching occurs, efforts to discuss commonalities with teachers of other disciplines can be productive to identify areas where positive references can be made to work in progress in other classes. Coordination of teaching or even teaming is enhanced by emphasizing problem solving in the curriculum.

Subject-centered instruction should not obviate the possibility of using good problem situations that might draw upon several disciplines. Many excellent problems are not just mathematics, just science, or just social studies. To avoid using them in a mathematics class (or other class) for that reason in short-sighted. The fact that they are interdisciplinary probably makes them potentially more valuable as a learning activity for students for just that reason. Problem solving in real life does not entail classification by subject matter but may well draw upon skills and information from a variety of resources.

Affective Considerations of Problem Solving

Affective dimensions of problem solving are more difficult to plan activities for than are cognitive traits. In some in-

stances, it is possible to design learning situations to encourage problem solving behaviors such as conjecturing, predicting, or drawing conclusions. However, other behaviors and problem solving traits may be more difficult to address through planned experiences. Self-reliance, risk-taking, creative thinking, interacting are examples of affective-related behaviors and traits that are fostered through a secure classroom environment, reinforcing teaching, and individual encouragement.

From a curriculum and teaching perspective, it is important to recognize the nature of these affective behaviors and to appreciate the role they play in problem solving. Traits such as critical judging may appear less threatening or bothersome when perceived as a integral and desirable aspect of a student's active internalizing and evaluating of a problem situation. Such feedback is certainly more desirable than the submissive response of a passive learner. Identifying traits and behaviors supportive of problem solving will further open up opportunities to instill and nurture such capabilities as they appear in learning situations. The following list of problem solving traits and behaviors may be helpful in assessing these affective problem solving abilities.

Traits of Good Problem Solvers

Curious — eager to investigate, to learn new approaches and techniques, to understand how a problem is solved.

Keen — interested in problems, quick to respond in class discussions and to individual challenges.

Interactive — participates freely with others, seeking and sharing ideas.

Creative — responds to problem situations in new or unusual ways; not confined in problem approaches or ways of thinking.

Receptive — willing to listen to and consider ideas of others.

Appreciative — enjoys and values the importance of problem solving activities, good problems, sound, clever, or different solutions.

Excitable — pursues a problem with great energy and intense interest that shuts out other activities temporarily.

Intuitive — able to act on hunches or educated guesses.

Retentive — draws upon and applies previously acquired information in new situations.

Self-Confident — believes that skills and abilities are adequate to meet the challenges of new problems.

Relishes Challenges — desires and enjoys pitting his/her abilities against problems.

Critical — evaluates ideas and explanations carefully; challenges classmates or teacher on incorrect or partial results; notes and looks for exceptions to generalizations.

Resilient — able to experience unsuccessful results without negative repercussions on his/her self-confidence.

Organized — approaches problems systematically, investigates problem ideas in a orderly, sequential manner; keeps a record of successful and unsuccessful attempts.

Tolerant — listens to ideas and problem approaches that are not personal choices; willing to bide time in making and seeing suggestions acted upon; respects problems solving efforts and achievements of others.

Resourceful — able to overcome obstacles in more than one way.

Flexible — capable of changing or expanding thinking to incorporate new or different ideas from others.

Self-Directed — motivated from within to pursue and continue with challenges.

Introspective—considers his/her own thinking processes in problem solving; reflects upon how new knowledge or discoveries integrate with previous information or thinking.

Risk-Taker — unafraid to be wrong in his/her ideas or to be unsuccessful in efforts to solve a problem; willing to forward ideas about a problem to others for evaluation.

Behaviors of Good Problem Solvers

Questions — expands upon problem solving discussion by asking about other cases; how the situation varies by changing givens; pursues matters that need clarification in his/her own or other's thinking; may challenge the need or application of learning content.

Notes Details — considers all information that may affect the outcome of a problem; alert to recognizing relationships among variable quantities.

Discriminates — perceives similarities and differences among objects or relationships which are important to the problem; distinguishes relevant information from irrelevant problem material.

Recognizes Patterns — detects similarities that characterize a set of information; able to predict missing elements.

Anticipates — examines alternatives using cause and effect reasoning without carrying action to conclusion; capable of meeting problems before they arise.

Predicts — foresees or foretells the outcome of or results to a problem, based upon previous background, experience, or reasoning.

Generalizes — extends the results of a particular problem or set of data to a larger and more general situation.

Visualizes — forms mental images of problem variables to preceive interrelationships among them.

Infers — examines problem information carefully to derive hypotheses and draw conclusions.

Speculates — reflects upon and reasons about problem components, interrelationships, and implications; forms educated conjectures from available evidence.

Concentrates — summons all of his/her skills and resources to attack a problem; overcomes extraneous influences and distractions.

Synthesizes — intergrates individually acquired skills and information into a larger understanding of the processes and components of problem solving.

Draws Conclusions — able to bring thinking to a decision to direct problem solving actions; able to summarize the results of problems or implications.

Deliberates — recognizes the appropriate times to consider carefully the information of a problem before acting, the implications of a result before generalizing, the alternatives before choosing.

Perseveres — persists with a problem despite lack of success, discouragement or opposition to his/her ideas, reluctant to "give up" on a problem.

Makes Refined Judgments — able to adjust his/her thinking or statements based upon additional information; able to improve the work of others by noting subtleties, distinctions, exceptions, or special cases.

Uses Divergent Thinking — able to perceive more than one implication or consequence to a problem action; able to consider unique or unusual approaches or outcomes to a problem; able to expand his/her thinking throughout a problem rather than narrowing it.

Role Modeling

A problem-solving curriculum can help develop good problem solving traits and behaviors by simply providing opportunities for students to exhibit such traits or behaviors. It is obvious that students cannot show their ability to recognize patterns, for example, if the curriculum does not contain problems that are built around patterns or sequences. Other traits and behaviors may best be taught not by changing the content of the curriculum but by teaching the content in ways that model good problem solving traits and behaviors. An area which is often overlooked involves the teacher as a true problem solver, rather than as a teacher of problem solving. In most instances, the blockage in student problems will be transparent to the teacher. Therefore, the problem is, in reality, a mere exercise for him/her. His/Her presentation of a problem to students or his/her assistance to them as they struggle with a problem will seem to be guided by inspiration and insight. Each move that he/she makes, each suggestion that he/she offers, turns out to be a good one. Therefore, students are likely to perceive problem solving as a series of uninterrupted steps of logical thinking that flow from some mystifying insight about the problem which they are unable to achieve. Not realizing that

frustration and uneven advances toward solution are, in fact, part of problem solving, the student senses inadequacy and failure when it is not warranted.

To accurately model problem solving, it is therefore necessary for the teacher occasionally to present problems which he/she has not previously solved, and which he/she does not immediately see through. This involves an element of risk, but no more so than the risk he/she is asking a student to undertake for a situation which is a true problem for him/her. The struggling for solution, the generation of alternatives, the discarding of ideas, the partial failures are all a realistic part of problem solving, including the eventual exhilaration that cannot be suppressed when the problem is eventually solved.

If the problem proves to be a particularly difficult one that does not yield to an immediate assault, the setting aside of the problem for another time, in a conspicuous place, demonstrates another aspect of an accomplished problem solver — the willingness to halt problem efforts temporarily and to return to the problem later with renewed vigor, persistence, and effort until it yields. If in the intervening time, the problem is first solved by a student, then all the better. The stature of students in problem solving endeavors will be enhanced through growing confidence. Class problem solving efforts will be perceived as more coequal endeavors and the teacher as a strong partner rather than always the leader and source of all information.

If students understand the full implications of the problem solving process, they will come to appreciate better the techniques and strategies for solving problems that provide them things to try. They will recognize the importance of not only thinking about the problem but of being aware of how they are going about that thinking. The importance of consciously expanding alternatives and possibilities, of looking at the problem components in different ways, of seeking creative and untried approaches will be appreciated. Then, in reviewing the successful solutions of others, they will be more sensitive to the need to look past the solution to the thinking underlying that solution. They will become more knowledgeable of the extent of work that precedes the polished and straightforward solutions that appear in textbooks or come from accomplished problem solvers.

Classroom Modeling

The ultimate goal of problem solving instruction is to develop the capability of students to apply school-learned skills successfully to problems arising in real life. However, experience indicates that transfer of school skills to life situations is not always an easy task. The degree to which classroom activities can realistically model real life problem solving is limited to how successfully students can make this transfer. There, an important teacher task is to be aware of real problem solving situations and to simulate them whenever possible.

—In a real situation, the task to be accomplished or the problem to be resolved is usually well understood. The problem may need to be recast in an appropriate representation, but generally there are no difficulties in interpreting the problem task from given information as is the case in textbook story problems.

—Real problems frequently deal with tactile materials and/or real people or situations. Being able to see the problem in terms of concrete materials or to associate it with specific persons or situations makes the problem easier to understand.

—Real problems have a built-in motivation factor. The successful solution of the problem accomplishes something for the solver. He/She can immediately appreciate his/her success or be penalized for his/her failure until the problem is solved. He/She is therefore willing to wrestle with a problem for a considerable period of time. This is in contrast to a school situation wherein a student either moves on from an unsuccessful problem attempt after a brief effort or seeks help from the teacher.

—There may not be a "correct solution" to a real problem. Many solutions may be acceptable in terms of the specific needs of the solver and the given situation. Rather than requiring an exact answer, it may be sufficient to be "close enough." For this reason, estimation and approximation skills are relatively high in importance in real problem solving.

—There is no preferred strategy to the successful solution of a real problem. The sole criterion is that the problem be successfully solved in an efficient manner to the problem solver. Therefore, trial and error might be judged just as satisfactory as a careful, reasoned problem attack — if it solves the problem.

—Real problem situations frequently reoccur for the solver. This gives the problem solver the motivation to find a solution method that will accomplish the repeated task more efficiently. He/She therefore has a reason to look for more than one solution process to the problem.

—Real problems are usually cluttered with irrelevant information or may even be missing some necessary data. One of the solver's first tasks is to distinguish between pertinent and non-pertinent information and to decide whether he/she has enough information to generate a solution.

—Few real problems are purely mathematical. The problem may consist of many non-mathematical elements. The task of the solver may be to restate and simplify the problem in mathematical terms. A mathematical solution may only be one component to the resolution of a larger problem. Affective considerations frequently play a role in real problem solving. Even though a mathematical solution may point toward one decision, the solver may choose another for reasons that have little to do with logic or reasoning.

It may not be possible or desirable to simulate each of these real life problem characteristics in classroom problem solving. However, an awareness of them should enable the teacher to frequently model such situations, making the transfer between school and life skills an easier task for students.

Problem Solving Commitment

Communication between teacher and students about instructional objectives occurs on several levels. There are those topics which students are told are important. There are matters which consume large amounts of instructional time. There are areas on which students are tested or otherwise evaluated.

If the importance of problem solving is verbalized but teaching and grading emphasis is placed upon accuracy of computations, students will identify computational proficiency as their target. If problem solving techniques are discussed periodically in class but are not modeled in other classroom activities, students are not likely to extend problem solving behaviors to those activities either.

When instructional time, teaching emphasis, evaluation activities, and objectives all consistently support problem solving learning, students will identify it as an area of importance for master. When the teacher models problem solving behaviors for all areas of instruction, students will begin to emulate these actions and extend problem solving concepts to other instructional topics and

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Patricia E. Blosser
Bulletin Editor

extra-school activities. When a teaching environment is created that stresses thinking about problems and encourages and values alternative and creative approaches to problem tasks, students will begin to perceive problem solving as a more important activity than an answer search.

Problem solving is more than a curriculum, and more than a method of teaching. It is a general attitude, a disposition toward inquiry which has as goals the discovery of new ideas and relationships based upon existing ones. It involves receptivity and appreciation for different views and approaches. It relishes the unique excitement and pleasure of mastering a difficult situation, of transforming a complex and puzzling problem into one of understanding and insight. But the price for these results is careful planning, curriculum development, teaching commitment, and hard work.

References

Balk, G. D. "Application of Heuristic Methods to the Study of Mathematics at School." *Educational Studies in Mathematics* 3: 133-46, 1971.

Brown, Stephen I. "From the Golden Rectangle and Fibonacci to Pedagogy and Problem Posing." *Mathematics Teacher* 69: 180-88, 1976.

Butts, Thomas. *Problem Solving in Mathematics*. Glenview, IL: Scott, Foresman and Co., 1973.

Carpenter, Thomas P. et al. "Solving Verbal Problems: Results and Implications from National Assessment." *Arithmetic Teacher* 28: 8-12; September 1980. (ь)

Carpenter, Thomas P. et al. "NAEP Note: Problem Solving." *Mathematics Teacher* 73:427-433; September 1980.

Carpenter, Thomas P. et al. *Results from the Second Mathematics Assessment of the National Assessment of Educational Progress*. Reston, VA. NCTM. 1981.

Driscoll, Mark J. "Mathematical Problem Solving: Not Just a Matter of Words." In *Research Within Reach: Elementary School Mathematics*. St. Louis, MO. CEMREL, inc., 1980.

Engel, A. "Outline of a Problem Oriented, Computer Oriented and Applicators Oriented High School Mathematics Course." *International Journal of Mathematics Education in Science and Technology* 4: 455-92, 1973.

Goldin, Gerald A. and C. Edwin McClintock, (Eds.) *Task Variables in Mathematical Problem Solving*. Columbus, OH. ERIC/SMEAC, November 1979. ERIC: ED 178 366.

Greenes, Carole E., J. Gregory, and Dale Seymour. *Successful Problem Solving Techniques*. Palo Alto, CA.: Creative Publications, 1977.

Greenes, Carole E., Robert E. Willcutt, and Mark A. Spikell. *Problem Solving in the Mathematics Laboratory*. Boston: Prindle, Weber & Schmidt, 1972.

Henney, Maribeth. "Improving Mathematics Verbal Problem-solving Ability through Reading Instructions." *Arithmetic Teacher* 18: 223-29, 1971.

Higgins, Jon L. "A New Look at Heuristic Teaching." *Mathematics Teacher* 64: 487-95, 1971.

Hints for Problem Solving. Topics in Mathematics for Elementary School Teachers series, bk. 17. Washington, DC: National Council of Teacher of Mathematics, 1969.

Hughes, Barnabas, *Thinking through Problems*. Palo Alto, CA.: Creative Publications, 1976.

Kinsella, John J. "Problem Solving." In *The Teaching of Secondary School Mathematics*, edited by Myron F. Rosskopf. Thirty-third Yearbook of the National Council of Teachers of Mathematics. Washington, DC: The Council, 1970.

Klamkin, Murray S. "On the Teaching of Mathematics So As To Be Useful" *Educational Studies in Mathematics* 1: 126-60, 1968.

Krulik, Stephen. *Problem Solving in School Mathematics*. 1980 Yearbook. Reston, VA: NCTM, 1980.

Krulik, Stephen and Jesse A. Rudnick. *Problem Solving: Handbook for Teachers*. Boston: Allyn & Bacon, 1980.

Krulik, Stephen and Ann M. Wilderman. "Mathematics Class + Strategy Games = Problem Solving." *School Science and Mathematics* 76: 221-25, 1972.

Meiring, Steven P. *Problem Solving ... A Basic Mathematics Goal: 1. Becoming a Better Problem Solver, 2. A Resource for Problem Solving*. Columbus, OH: Ohio Department of Education, 1980. (a.b.)

NCSM. "Position Paper on Basic Mathematical Skills." National Council of Supervisors of Mathematics, 1977. ERIC: ED 139 654.

NCTM. *An Agenda for Action: Recommendations for School Mathematics of the 1980s*. Reston, VA: NCTM, 1980.

NCTM Priorities in School Mathematics: Executive Summary. Reston, VA: NCTM, 1981.

Pollak, Henry O. "How Can We Teach Applications of Mathematics?" *Educational Studies in Mathematics* 2: 393-404, 1969.

Polya, G. *How to Solve It*. Princeton, NJ: Princeton University Press, 1945.

Richardson, Lloyd I. "The Role of Strategies for Teaching Pupils to Solve Verbal Problems." *Arithmetic Teacher* 22: 414-21, 1975.

Sowder, Larry et al. *A Review of Research on Solving Routine Problems in Pre-College Mathematics*. DeKalb, IL: Northern Illinois University, 1979. ERIC: ED 182 175.

Suydam, Marilyn N. "Update: The Evidence on Problem Solving." *Arithmetic Teacher*, in press.

Suydam, Marilyn N. and Fred J. Weaver. "Research on Problem Solving: Implications for Elementary School Classrooms." *Arithmetic Teacher* 25: 40-42, November 1977.

"Teaching via Problem Solving." In *Didactics and Mathematics*. Palo Alto, CA: Creative Publications, 1978.

Thompson, M. *Experiences in Problem Solving*. Reading, MA. Addison-Wesley Publishing Co. 1976.

Troutman, Andria P., and Betty P. Lichtenberg. "Problem Solving in the General Mathematics Classroom." *Mathematics Teacher 67: 590-97, 1974.*

Walter, Marion I., and Stephen I. Brown. "Problem Posing and Problem Solving: An Illustration of Their Interpedence." *Mathematics Teacher* 70: 4-13, 1974.

Whirl, Robert J. "Problem Solving—Solution or Technique." *Mathematics Teacher* 66: 551-53, 1973.

Wickelgren, Wayne A. *How to Solve Problems*. San Francisco: W. H. Freeman & Co., 1974.

Writz, R. *Banking on Problem Solving in Elementary School Mathematics*. Washington, DC: Curriculum Development Associates, 1976.

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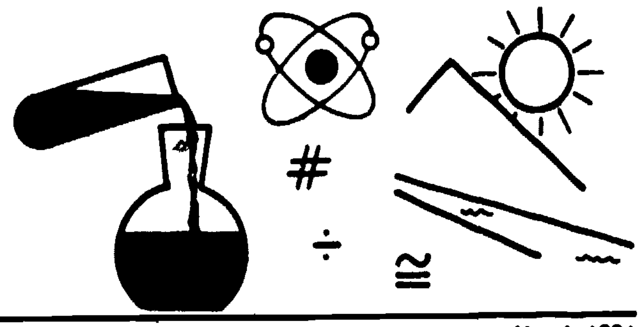

Information Bulletin No. 4 1981

ANNUAL ISSUE

Editor's Comments

This annual issue of the ERIC/SMEAC information bulletin contains a variety of information that we hope will be of interest to ERIC users. It is designed to give the reader an overview of clearinghouse activities for the past year, especially in terms of those publications teachers may find useful.

This year we have produced 12 ERIC/SMEAC fact sheets: four in each area-science education, mathematics education, and environmental education. (These are available at cost; see ordering details elsewhere in this issue.) Comments received about these fact sheets have been positive and we plan to continue their production for 1982, producing three per area. Although specific topics for the 1982 fact sheets have not yet been chosen, we have received some suggestions. Topics suggested for science education fact sheets include science teacher supply and demand, teaching inquiry in science, the use of microcomputers in science classes, teaching science to middle school students, and instructional materials for science teaching. Topics suggested for mathematics education fact sheets include unpublished instruments in mathematics education, teaching elementary school mathematics, and mathematics materials. Topics suggested for environmental education fact sheets include global education, energy education, cognitive instruments in environmental education research, and instructional materials for environmental education.

We also plan to continue to publish the information bulletin, with one issue focused on each of the content areas covered by our clearinghouse. These, according to the policy established last year, will be available at cost. The annual issue of the bulletin is free.

Again we ask that you cooperate with us in completing the form in this bulletin that is headed "ERIC/SMEAC mailing label corrections." Each year the list of individuals and organizations receiving our materials grows longer. We need to try to keep costs down by removing from our mailing list those who are no longer interested in receiving our announcements. If we do not receive a completed form from you, we will consider this lack of response to indicate a lack of interest and will remove your name and address from our mailing list. To continue to receive our materials, please complete and return the form as soon as possible upon receipt of this issue of the bulletin.

IMPORTANT! PLEASE NOTE!

TIME TO RENEW

In issue no. 4, 1980, we announced that ERIC/SMEAC was unable to distribute information bulletins and fact sheets free to all persons interested in receiving them. The same situation holds true for 1982. In 1981 ERIC Standing Order Customers, State Coordinators and Dissemination Officers, Federal Agencies, some school districts, some teacher education institutions, and the headquarters office of professional associations and journals received free materials, and these persons and groups will continue to receive them in 1982. However, if there are changes that should be made for more accurate mailing information, our clearinghouse needs to know what these changes are.

For those persons and groups who have subscribed for information bulletins and fact sheets, now is the time to renew your subscriptions. For others who may wish to subscribe, this is the logical time to begin. An information request form is included in this issue and may be used to renew or begin subscriptions.

Recent ERIC/SMEAC Information Analysis Products

During 1980-1981 the ERIC Clearinghouse for Science, Mathematics and Environmental Education was responsible for producing Information Analysis Products (IAPs) of interest to teachers, at all levels, of science, mathematics, or environmental education. Some of the IAPs are highlighted in this issue.

Science Education

Improving Practices in Middle School Science, AETS Yearbook
V. Daniel Ochs, editor

The 1981 yearbook of the Association for the Education of Teachers in Science contains papers focused on the teaching of science to middle school students. Guided by model of curriculum and instruction first presented by Ralph Tyler in his 1949 book entitled Basic *Principles of Curriculum and Instruction*, each of the authors of the first six chapters considered one or more of the variables to be found in a middle school science classroom: the learners, the teacher, educational objectives, content, and the realities in which middle schools exist. The next three chapters contain information about specific programs or practices designed to improve middle school science teaching: the BSCS Human Sciences Program, preservice middle school science teacher education, and inservice teacher education. The final chapter contains three reactions from inservice teachers and administrators in middle schools. ERIC/SMEAC price: $8.50 (ED 205 369)

A Critical Review of the Role of the Laboratory in Science Teaching
Patricia E. Blosser

Science educators "know" that the use of the laboratory in science teaching is important. However, much of the re-

search focused on the use of the laboratory as an instructional method has not produced results at a level of statistical significance in favor of the laboratory. This review was designed to take yet another look at the role of the laboratory in science teaching. Information is reported on opinion papers as well as on research studies. Two major topics are considered: why the laboratory should be used for science instruction and the goals and objectives this use is intended to accomplish. ERIC/SMEAC price: $5.00 (SE 034 834. This document will be announced in the January 1982 issue of *Resources in Education.*)

Research in Science Education: New Questions, New Directions
James T. Robinson, editor

This publication contains 10 papers presented at a 1980 conference designed to focus on several questions: What areas of research hold exciting promise for the improvement of science instruction? What areas of research attack old intractable problems in a new and different way? What areas of research are conceptually innovative, that is, have not been extensively applied to the study of teaching and learning mathematics and science? What areas of research stay close to what actually occurs in science and mathematics classrooms? Data from the analysis of curriculum materials, especially textbooks; from investigations of the science understandings of students and experts; and from investigations of the contextual factors of science classrooms were used in considering the answers to these questions. ERIC/SMEAC price: $5.75 (SE 035 716)

A Summary of Research in Science Education-1979
David P. Butts

This information analysis product, developed in cooperation with the National Association for Research in Science Teaching, is designed to provide the science education community with an analysis and synthesis of research related to the teaching and learning of science completed and published in 1979. This document is not available from ERIC/SMEAC but may be purchased from Wiley-Interscience, John Wiley & Sons, 1 Wiley Drive, Somerset, NJ 08873, ISBN 0-471-86587-7 for $20.00. (ED 204 102)

Activity Sourcebook for Earth Science
Victor J. Mayer, compiler-editor

Prepared in cooperation with the National Association of Geology Teachers, this publication is designed to bring to secondary school teachers of earth science (and also general science and biology) activities and information that will assist them in keeping their curricula up to date. Activities are grouped into chapters on weather and climate, oceans, the earth and its surface, plate tectonics, uses of space photography, and space ERIC/SMEAC price: $7.75 (SE 033 913, to be announced in April 1982 issue of *Resources in Education).*

Mathematics Education

Especially for Teachers: ERIC Documents on the Teaching of Mathematics, 1966-1980
Marilyn N. Suydam and Jon L. Higgins, compilers

Over 900 citations on materials related to mathematics instruction for teachers are contained in this publication. Citations were selected from documents listed in *Resources in Education* (RIE) between 1966 and 1980. Citations have been grouped under the following headings. algebra, applications, calculators and computers, calculus, career education, consumer education, decimals, diagnosis, enrichment, environmental concerns, fractions, general mathematics, geometry, graphing and functions, low achievers, measurement, metric measurement, numbers and numeration, objectives, operations, percent/ratio and proportion, planning, probability and statistics, problem solving, testing, and varied topics ERIC/SMEAC price. $6.50, $1.50 extra for binder (ED 199 053).

Environmental Education

Environmental Education in Action IV. Case Studies of Teacher Education Programs for Environmental Education
Mary Lynne Bowman and John F. Disinger, compilers-editors

Presented are 25 case studies of teacher education programs related to environmental education Both inservice and preservice programs, as well as combination programs, are included. Many of the areas commonly subsumed under the environmental education "umbrella" are included, such as conservation education, energy education, marine education, and outdoor education. The programs described are not advanced as "models," but rather as examples of functioning programs. ERIC/SMEAC price: $5.50 (ED 202 665).

Current Issues in Environmental Education and Environmental Studies, Volume VII: Selected Papers from the Tenth Annual Conference of the National Association for Environmental Education (Kentucky Dam Village, 1981)
Arthur B. Sacks, Louis A. Iozzi, Judith M. Schultz, Richard Wilke, editors

Following a foreword by S David Freeman, papers are presented that were selected from those given at the conference The papers are arranged in three sections The first contains four invited addresses and two symposia reports. The second section contains 12 descriptive papers, while the third contains seven papers based on original research and thought. This is the seventh annual volume of NAEE conference papers published by ERIC/SMEAC This publication will be available from ERIC/SMEAC early in 1982, and also will be announced in *Resources in Education.* (SE 035 950)

Natural Resources Management Activities for the Classroom
Mary Lynne Bowman

Classroom activities for students in grades K-12 provide a variety of approaches to using natural resources management considerations in the teaching of environmental education. Activities are keyed to resource management concepts, grade levels, and appropriate curricular areas. When this publication is available from ERIC/SMEAC in early 1982, it also will be announced in *Resources in Education* (SE 035 951)

Readers wishing to order any of these publications may either contact the Information Reference Center, 1200 Chambers Road, Columbus, OH 43212 or may purchase the publications (with the exception of the 1979 Review of Research) from the ERIC Document Reproduction Service, (EDRS) P. O Box 190, Arlington, VA 22210 Materials ordered from EDRS may be purchased as microfiche or papercopy. Prices for microfiche or papercopy are quoted in the document resumes in *Resources in Education* (RIE). Clearinghouse documents with SE numbers have been sent to EDRS for inclusion in some future issue of RIE When the document resume appears in RIE, it will have an ED number in addition to its SE number.

ERIC/SMEAC prices for documents are for pre-paid orders. Orders which must be billed will be charged for postage and handling, in addition to the costs of the documents ordered

Special Sale On Some ERIC/SMEAC Publications

Our clearinghouse personnel and professional organizations continue to produce information analysis products, as has been the custom for the past 16

years. However, the walls of 1200 Chambers Road do not expand. As a result, the SMEAC Information Reference Center is having a special sale of some of the less recent publications.

These "Oldies but Goodies" are available at 40% off the already low publication price. The sale will last until March 1, 1982 or until the surplus inventory on the sale books has been sold. TO QUALIFY FOR THE DISCOUNT PRICES, AN ORDER FOR DISCOUNTED BOOKS MUST TOTAL $25.00 OR MORE.

A special publication list of sale books is available upon request. Write to the SMEAC Information Reference Center, 1200 Chambers Road, Rm. 310, Columbus, OH 43212 or telephone (614) 422-6717 if you wish to receive a copy of this list.

Publications in all three areas (science education, mathematics education, environmental education) are on sale. The 1972 *Review of Research related to Environmental Education, Environmental Education Abstracts and Index to Research in Education 1966-1972* (a handy resource for manual searchers), *Man and Environment Teaching Alternatives,* and *Current Issues in Environmental Education - III: Selected Papers from the Sixth Annual Conference of the National Association for Environmental Education* are among the 17 environmental education publications available at special prices. Among the 17 science education publications on sale are *Handbook of Unpublished Evaluation Instruments in Science Education, Volume II; A Review of Research on Teacher Behavior Relating to Science Education; A Summary of Research in Science Education-1972;* and *Attitudes toward Science: Investigations.* Among the 21 mathematics education publications are *Promising Practices in Mathematics Teacher Education, Cognitive Psychology and the Mathematics Laboratory, Mathematics Laboratories: Implementation, Research and Evaluation,* and *Materials for Metric Instruction.*

Also available as part of this special sale are volume sets of *Investigations in Science Education* (four issues per volume), Volumes 1 through 6.

Orders will be filled as they are received. Readers wishing to take advantage of this sale should order as soon as possible if they wish to get the publications requested.

Previous ERIC/SMEAC User Services Publications Still Available

There is good news for those ERIC users who wish to purchase additional, or replacement, copies of back issues of the 1979, 1980, and 1981 information bulletins and the 1981 fact sheets. These materials are still available. Each publication costs $1.00. If purchased in sets (e.g. all four issues of the 1980 information bulletin or all four fact sheets in one area), the cost is $3.00 for a set of four publications.

For quick reference, the titles of these materials are shown below:

1979 information bulletins

- Summary of NSF Literature Review in Science Education, Spring 1979
- Summary of NSF Literature Review in Mathematics Education, Summer 1979
- National Assessment Studies Energy Education, Autumn 1979
- Some Topics of Current Interest to Teachers of Science, Mathematics and Environmental Education, Winter 1979

1980 information bulletins

- An Interpretive Summary from the NCTM Project "Priorities in School Mathematics," No. 1, 1980
- Materials on Energy-Related Careers, No. 2, 1980
- Safety in the Science Classroom, No. 3, 1980
- Annual Issue, No. 4, 1980

1981 information bulletins

- Citizen Participation Materials, No. 1, 1981
- Project Synthesis, No. 2, 1981
- Problem Solving Goals: Cognitive and Affective, No. 3, 1981
- Annual Issue, No. 4, 1981

1981 science education fact sheets

- No. 1, Teaching Controversial Issues in the Science Classroom: Creationism vs. Evolution
- No. 2, Sources of Information on Science Careers
- No. 3, Sources of Information about Science Activities for Special Students
- No. 4, The Role of the Laboratory in Science Teaching

1981 mathematics education fact sheets

- No. 1, Females and Mathematics
- No. 2, The Problem of Problem Solving
- No. 3, Mathematics Teacher Supply and Demand
- No. 4, Microcomputers and Mathematics Instruction

1981 environmental education fact sheets

- No. 1, Environmental Education Program Evaluation
- No. 2, Simulation Activities for Environmental Education
- No. 3, Learning Activities for Environmental Education
- No. 4, The State Education Agencies and Environmental Education

Readers wishing to purchase these materials should send their requests to the ERIC/SMEAC Information Reference Center. Payment must be included with order for all orders totalling $10.00 or less.

Information Services Available from ERIC/SMEAC

Listed below are services available from ERIC/SMEAC. You can request these materials or services by using the information request form found in this bulletin. Some services are free, others have a cost involved.

Free Services

1. The annual information bulletin
2. General information about ERIC or ERIC/SMEAC
3. ERIC/SMEAC publication lists
4. Information about ERIC microfiche collections in your state
5. Information about computer search services available in your state
6. Information about specific publications
7. Assistance in locating information on topics within our scope areas (science education, mathematics education, environmental education)

Services for Which There Is a Charge

1. ERIC/SMEAC Publications
The SMEAC Information Reference Center currently has available over 100 publications related to science, mathematics or environmental education. Included are teaching guides, instructional materials, directories, research reviews, collected papers, bibliographies, and other items. Costs vary from about $1.00 to about $20.00. Most items are under $6.00. Publication lists can be requested by using the request form.

2. Information Bulletins and Fact Sheets
Our Clearinghouse plans to produce *four* information bulletins in 1982. Each bulletin will be eight pages in length. A subscription for the four bulletins for 1982 is $3.00.

A list of back issues of information bulletins is available, also. Bulletins produced prior to 1982 are available for $1.00 per bulletin. Extra copies of the 1982 bulletins will be available for $1.00 each.

The Clearinghouse will also produce 9 fact sheets (three in each area: science, mathematics, environmental education) in 1982. Each fact sheet will be two pages in length. Subscriptions to fact sheets are $1.00 for three fact sheets in one area. A subscription for fact sheets in all three areas (science, mathematics, environmental education) is $3.00. Individual fact sheets can be purchased for $1.00 each.

3. Scanned Computer Searches of the ERIC Data Base (RIE and/or CIJE)
Abstracts and other relevant information will be provided for requests at the current rate of $15.00 per 50 abstracts for the first 50 abstracts and $10.00 for every additional 50 abstracts thereafter. These searches are scanned for relevance so that items not relating to the request can be removed. At the present time an aver-

age ERIC search costs $30-40. Searches of other data bases can also be done. Costs vary with the charges of the specific data base. Contact us for cost estimates.

4. Evaluative Comments Related to the Output of the Computer Search

Sometimes an ERIC user desires some evaluative information about the computer output. Questions such as "which are the better materials for our school?" "what are some of the better programs for our school?" or "which are some of the better research studies?" are frequently asked. Responses to questions can be provided at a cost of $10.00 per hour of staff time.

5. Compilations of Materials in *Resources in Education* (RIE) in Science Education, in Mathematics Education, or in Environmental Education for 1966-1972, 1973-1975, 1976-1977

Our Clearinghouse has cooperated with The Ohio State University to produce compilations that provide abstracts, a descriptor index, an identifier index, an author index, and an institutional index for each of our areas of responsibility: science education, mathematics education, and environmental education. These publications are "bargains" compared to *any* computer searches and permit manual searches at a very rapid rate. Compilations for 1978-1980 are being produced. These publications are listed in the ERIC/SMEAC publications list and are priced from $15 to $22 each, depending upon the document.

6. Consulting Service

To provide additional help regarding selection of programs, materials, research studies, etc., we have available further assistance, if desired. Costs of such service will be negotiated prior to rendering the service.

ERIC Clearinghouse Network

As most readers of this bulletin know, ERIC is an acronym for the Educational Resources Information Center, which is not really a center but is, rather, a nationwide network of 16 clearinghouses under the direction of the National Institute of Education (NIE). Each clearinghouse specializes in a particular area of education and works with Central ERIC in N.. to form a national information system. The clearinghouses and their addresses and phone numbers are listed below.

ADULT, CAREER, AND VOCATIONAL EDUCATION
The Ohio State University
Center for Vocational Education
1960 Kenny Road
Columbus, Ohio 43210
(614) 486-3655

COUNSELING AND PERSONNEL SERVICES
University of Michigan
... of Education Building, Rm. 2108
...rbor, Michigan 48109
...764-9492

EDUCATIONAL MANAGEMENT
University of Oregon
Eugene, Oregon 97403
(503) 686-5043

ELEMENTARY AND EARLY CHILDHOOD EDUCTION
University of Illinois
College of Education
1310 South Sixth St.
Champaign, Illinois 61820
(217) 333-1386

HANDICAPPED AND GIFTED CHILDREN
Council for Exceptional Children
1920 Association Drive
Reston, Virginia 22091
(703) 620-3660

HIGHER EDUCATION
George Washington University
One Dupont Circle, Suite 630
Washington, DC 20036
(202) 296-2597

INFORMATION RESOURCES
Syracuse University
School of Education
Syracuse, New York 13210
(315) 423-3640

JUNIOR COLLEGES
University of California at Los Angeles
Powell Library, Room 96
Los Angeles, California 90024
(213) 825-3931

LANGUAGES AND LINGUISTICS
Center for Applied Linguistics
3520 Prospect St., N.W.
Washington, D.C. 20007
(202) 298-9292

READING AND COMMUNICATION SKILLS
National Council of Teachers of English
1111 Kenyon Road
Urbana, Illinois 61801
(217) 328-3870

RURAL EDUCATION AND SMALL SCHOOLS
New Mexico State University
Box 3AP
Las Cruces, New Mexico 88003
(505) 646-2623

SCIENCE, MATHEMATICS, AND ENVIRONMENTAL EDUCATION
The Ohio State University
1200 Chambers Road, Third Floor
Columbus, Ohio 43212
(614) 422-6717

SOCIAL STUDIES/SOCIAL SCIENCE EDUCATION
855 Broadway
Boulder, Colorado 80302
(303) 492-8434

TEACHER EDUCATION
American Association of Colleges for Teacher Education
One Dupont Circle, NW, Suite 610
Washington, DC 20036
(202) 293-7280

TESTS, MEASUREMENT, AND EVALUATION
Educational Testing Services
Princeton, New Jersey 08541
(609) 921-9000 ext. 2176

URBAN EDUCATION
Box 40
Teachers College, Columbia University
525 W. 120th Street
New York, New York 10027
(212) 678-3437

Readers may wish to write to one or more clearinghouses to request a copy of that particular clearinghouse's publications list or to be placed on the mailing list.

If readers are interested in submitting educational materials to the ERIC data base, they may send these materials to a specific clearinghouse if the materials fall within the clearinghouse's scope of interest. It is also possible to send materials to the ERIC Processing and Reference Facility for distribution to the appropriate clearinghouse. The Facility's address is

ERIC Processing and Reference Facility
4833 Rugby Avenue, Suite 303
Bethesda, MD 20014.

ERIC

ERIC CLEARINGHOUSE FOR SCIENCE, MATHEMATICS, AND ENVIRONMENTAL EDUCATION
1200 Chambers Road
Columbus, Ohio 43212

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Patricia E. Blosser
Bulletin Editor

ERIC/SMEAC INFORMATION REFERENCE CENTER
The Ohio State University
1200 Chambers Road, 3rd Flr.
Columbus, OH 43212

Information Request Form

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Information Desired (Check all appropriate sections)

1. Mailing list request form and annual bulletin (free) ________
2. Publication lists (free) ________
3. Short Guide to ERIC and ERIC/SMEAC (free) ________
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5. List of computer search services in my state (free) ________
6. Listing of past Information Bulletins and Fact Sheets (free) ________
7. Computer Search Service
   If you desire to contract for search help, include your telephone number and best time of day to reach you by telephone. A staff member will call to discuss your search and to provide an estimate of the cost that would be involved. Please include a statement regarding the information desired so that the ERIC staff person in the appropriate content area can contact you.

   Telephone number (_____)____________________

   Search desired:

8. Consulting Services
   Include your telephone number and specify the type of assistance desired. A staff member will call you to discuss your interests so indicate the best time of day to be called.

   Telephone number (_____)____________________

   Assistance desired:

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(Check items desired, compute costs)

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1. 1982 ERIC/SMEAC Information Bulletins 4 issues/year, $3.00 per year	________	________
2. 1982 ERIC/SMEAC Fact Sheets for Environmental Education 3 issues/year, $1.00 for all three issues	________	________
3. 1982 ERIC/SMEAC Fact Sheets for Mathematics Education 3 issues/year, $1.00 for all three issues	________	________
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